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APPLICATION OF INTERNATIONAL WATER LAW TO TRANSBOUNDARY GROUNDWATER RESOURCES, AND THE SLOVAK-HUNGARIAN DISPUTE OVER GABČIKOVO-NAGYMAROS

GABRIEL ECKSTEIN^{*}

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INTRODUCTION

The persistent growth in world population¹ and economic development² has resulted in tremendous pressures on exist-

1. See WORLD RESOURCES INSTITUTE, UNITED NATIONS ENVIRONMENTAL PROGRAMME, UNITED NATIONS DEVELOPMENT PROGRAMME, *WORLD RESOURCES 1992-93: A GUIDE TO THE GLOBAL ENVIRONMENT* 75 (1992) [hereinafter *WORLD RESOURCES 1992-93*] (noting that global population doubled between 1952 and 1992).

2. Lester R. Brown, *Facing Food Insecurity*, in *STATE OF THE WORLD* 177, 181 (Lester R. Brown ed., 1994) (explaining five-fold growth in the global

ing sources of fresh water.³ Human water use over the past three centuries increased by a factor of thirty-five and is growing by four to eight percent annually.⁴ Coupled with recurring international disputes over water resources,⁵ poor water management,⁶ and the realization that water is an indispensable but finite resource, these trends have pro-

economy between 1950 and 1990 - from four trillion to nineteen trillion dollars); *cf.* WORLD RESOURCES 1992-93, *supra* note 1, at 1 (stating that at the current rate of growth of three percent, the global economy will be five times larger in 2050 than it is today).

3. See Robert D. Hayton & Albert E. Utton, *Transboundary Groundwaters: The Bellagio Draft Treaty*, 29 NAT. RESOURCES J. 663, 663, 674, 680 (1989) (asserting that development and population expansion are causing cities throughout the world to become "critically dependent on groundwater"); *see also* Peter H. Gleick, *Water and Conflict: Fresh Water Resources and International Security*, 18 INT'L SECURITY 79, 90 (1993) (noting that in the 1980s, 1.3 billion persons did not have access to potable water while over 1.7 billion persons did not have access to adequate sanitation facilities; by the year 2000, both of these figures are expected to increase by nearly 1.0 billion); *cf.* Cari Votava, *The Non-Navigational Uses of International Watercourses*, 84 AM. SOC'Y INT'L L.: PROC. 228, 228 (1990) (remarks by Stephen McCaffrey) (contending that competition over water resources will likely increase as a result of growing population).

4. WORLD RESOURCES 1992-93, *supra* note 1, at 160-61 (discussing global withdrawals of fresh water by various industries).

5. See Votava, *supra* note 3, at 229 (remarks of Stephen McCaffrey) (giving brief descriptions of recent and ongoing disputes over international water resources); *see also* Gleick, *supra* note 3, at 79, 87-89 (asserting growing demand for limited water resources will likely result in an increase in international conflict).

In recent years, disputes over water resources have occurred in Southeast Asia, North and South America, and most notably in the Middle East. *See* Peter H. Gleick, *Reducing the Risks of Conflict Over Fresh Water Resources in the Middle East*, in WATER AND PEACE IN THE MIDDLE EAST 41 (H. Shuval & J. Issac eds., 1994). Periodically, water disputes have resulted in military action. During the 1950s and 1960s, armed conflicts arose between Israel and Syria over the headwaters of the Jordan. *See* Peter H. Gleick, *Water and War in the Middle East*, in ENERGY & ENVIRONMENTAL STUDY INSTITUTE, BRIEFING FOR THE U.S. CONGRESS 1, 3 (November 5, 1993); *cf.* Gleick, *supra* note 3, at 79 (describing cases where water use projects became targets of military action).

6. *See* Albert E. Utton, *The Development of International Groundwater Law*, in INT'L. GROUNDWATER L. 7 (Ludwick A. Teclaff & Albert E. Utton eds., 1981) (noting that the international community is awakening now to the consequences of poor water management); *see also* Donald J. Chenevert, Jr., *Application of the Draft Articles on the Non-Navigational Uses of International Watercourses to the Water Disputes Involving the Nile River and the Jordan River*, 6 EMORY INT'L L. REV. 495, 500 (1992) (noting states are beginning to develop more efficient means for using and preserving water resources in order to prevent shortages and water quality degradation).

pelled the use and management of transboundary groundwater⁷ resources to the forefront of legal debate.⁸

Until recently, matters relating to groundwater resources were relatively ignored in the context of international law applicable to transboundary water resources.⁹ In particular, international water law failed to satisfactorily consider or comprehend the physical interrelationship and interdependence between surface and groundwater resources.¹⁰ As a consequence, most legislators, policymakers, and even international legal scholars continue to regard underground water sources as dissimilar from surface waters with respect to

7. The term groundwater generally refers to any water located beneath the earth's surface that saturates a geologic bed. See MICHAEL PRICE, *INTRODUCING GROUNDWATER* 7 (1985) (offering a basic explanation of the difference between surface and groundwater); ROBERT BOWEN, *GROUNDWATER* 3 (1986) (differentiating between water in saturated and unsaturated zones); see also RALPH C. HEATH, U.S. DEP'T OF INTERIOR, *GROUND-WATER HYDROLOGY* 2220 (1984) (explaining that only underground water found in the saturated zone is considered groundwater).

Groundwater comprises a little more than one half of one percent of the total volume of water found in nature, but it makes up nearly one hundred percent of the fresh water readily available to man. See HERMAN BOUWER, *GROUNDWATER HYDROLOGY* 2-3 (1978) (charting quantities of fresh and saline surface and groundwater, and explaining that groundwater represents about 0.6% of the earth's total water supply). Surface water, such as that in lakes and streams, and atmospheric water vapor, make up a negligible amount totaling less than 0.1% of the total amount of fresh water found on Earth. See Julio Barberis, *International Groundwater Resources Law in FOOD AND AGRIC. ORGANIZATION LEGIS. STUDY NO. 40*, at 1 (1986); cf. Bouwer, *supra* at 3 (explaining that the total volume of readily usable groundwater, i.e., accessible and not saline, constitutes approximately 4.2×10^6 km³, while lakes and streams contain only about 0.126×10^6 km³ of fresh water); see also PRICE, *supra* at 8 (detailing various water volumes and comparing with groundwater volumes).

For a basic understanding of groundwater and groundwater resources, see PRICE, *supra*; HEATH, *supra*. For a more advanced discussion of groundwater resources and the science of hydrogeology. See generally C.W. FETTER, *APPLIED HYDROGEOLOGY* (2d ed. 1988).

8. See Robert D. Hayton, *The Ground Water Legal Regime as Instrument of Policy Objectives and Management Requirements*, in INT'L GROUNDWATER L. 57-58 (Ludwick A. Teclaff & Albert E. Utton eds., 1981) (noting that decreasing sources of fresh water are forcing attention on groundwater resources); cf. Chenevert, Jr., *supra* note 6, at 497-500 (noting that the growing importance of groundwater resources in states' planning agendas is the result of societal development, the desire to maintain and improve quality of life, and the growing involvement of international bodies in international water issues).

9. See *infra* notes 92-93 and accompanying text.

10. See *infra* notes 94-96 and accompanying text.

ownership and usage, and omit the resource from the legal regime of international water law.¹¹

Part I of this article examines international water law and proposes the application of this legal regime to both surface and underground waters equally and without distinction. This application is founded on the basis that due to the indissociable nature of and interdependency between the two water resources, surface and underground waters cannot be utilized or protected adequately or efficiently unless they are considered simultaneously under the same rubric of management and law.

Section A of Part I discusses the general legal principles that comprise international water law, and that heretofore were applied primarily to surface water resources. Excepting the first two precepts, which are offered solely as background for the other more modern legal norms, it is these principles which are applicable to underground waters. Section B follows with a basic scientific approach towards describing underground water resources. This Section is fundamental to an adequate understanding of subsurface waters, and particularly of the premise that international water law should encompass groundwater, because it describes the physical nexus typically found between surface and subsurface waters. Thereafter, Section C presents an overview of the international legal regime of transboundary waters, which includes groundwater resources, as defined and codified by international organizations and instruments. Part I concludes in Section D with a summary and some closing remarks.

In Part II of this article, groundwater issues are considered in the context of the ongoing Gabčíkovo-Nagymaros

11. See Albert E. Utton, *International Groundwater Management: The Case of The U.S.-Mexican Frontier*, in *INTERNATIONAL GROUNDWATER LAW* 157, 178 (Ludwick A. Teclaff & Albert E. Utton eds., 1981) [hereinafter *U.S.-Mexican Frontier*] (declaring that the law often created a distinction between surface and groundwater contrary to scientific reality); Utton, *supra* note 6, at 4 (contending that the legal regime governing groundwater resources is inadequate while the law regulating transboundary groundwater resources is only now being developed); Hayton, *supra* note 8, at 57-58 (demonstrating that regulation of groundwater is more a case of non-management than mismanagement).

controversy between Hungary and Slovakia. Although the controversy does not focus solely on groundwater issues, the dispute provides fertile ground for the application of international water law, in its fullest sense, to questions of the use and ownership of transboundary groundwater resources.

PART I

A. *Principles of International Water Law*

International water law, as with every facet of international law, is the product of decades of legal development. It is comprised of customs and principles which have been interpreted and refined by scholars and national legislatures as well as by societal development. In the following, the major principles of international water law are offered and discussed. It is noteworthy that the principles cover a broad period of time in terms of international acceptance. Sections A and B present the traditional principles of absolute territorial sovereignty and absolute territorial integrity, precepts which underlay classical international relations among nations. Although neither are widely accepted nor practiced today in the international community, discussion of these principles serves to establish the foundation upon which much of contemporary international water law is based. A third classical principle of international law, which still has relevancy and wide acceptance today, is offered in Section C, that of *Sic Utere Tuo Ut Alienum Non Laedas* — the obligation not to cause appreciable harm. Sections D, E, and F examine the more contemporary principles of reasonable and equitable utilization, of the community of interests, and of prior notice and negotiation. This latter group developed, in part, from the first three and as a result of the need for new conceptions to deal with modern issues of transboundary resources.

1. Principle of Absolute Territorial Sovereignty

The principle of absolute territorial sovereignty suggests that states have the right to unrestrained use of resources found within their territories, regardless of the transboundary consequences of such use.¹² This principle is often equated with the Harmon Doctrine.¹³ Although not parallel, the two concepts are complementary, as the Harmon Doctrine asserts that in the absence of established law to the contrary, states are free to exploit resources within their jurisdiction without regard to the extraterritorial effects of such action.¹⁴

The great majority of states and legal publicists have rejected this principle outright.¹⁵ In the *Lake Lanoux Arbi-*

12. See James O. Moermond & Erickson Shirley, *A Survey of the International Law of Rivers*, 16 DENV. J. INT'L L. & POL'Y 139, 140 (1987); see also Cecil J. Olmstead, *Introduction*, in *THE LAW OF INTERNATIONAL DRAINAGE BASINS* 1, 3 (Albert H. Garretson et al. eds., 1967). Olmstead regards this principle as stemming from the historic paradigm that states, as sovereign nations, have unlimited control and jurisdiction over the entire physical territory of their domain. He also attributes the principle to a general aversion of states to accede to a negotiated compromise, or to the authority and decision of an international body for resolving disputes, over such important resources as water. Olmstead, *supra*, at 3.

13. See Jonathan E. Cohen, *International Law and Water Politics of the Euphrates*, 24 J. INT'L L. & POL. 503, 522 (considering the Harmon Doctrine to be the "colloquial name" for the principle). The Doctrine is named after former United States Attorney General Judson Harmon. *Id.* In 1895, in response to a dispute between the United States and Mexico over the utilization of the Rio Grande, Attorney General Harmon declared that "the rules, principles, and precedents of international law impose no liability or obligations upon the United States." 21 Op. Att'y Gen. 274 (1895), reprinted in Jerome Lipper, *Equitable Utilization*, in *THE LAW OF INTERNATIONAL DRAINAGE BASINS* 15, 20 (Albert H. Garretson et al. eds., 1967).

14. See Jerome Lipper, *Equitable Utilization*, in *THE LAW OF INTERNATIONAL DRAINAGE BASINS* 15, 22 (Garretson, et. al. eds. 1967) (pointing out that Harmon's statement merely implied that because no established international rule prohibited the United States conduct, the U.S. was free to continue it).

15. See Chenevert, *supra* note 6, at 503 (denouncing principle of absolute state sovereignty because it contradicts the principle of *sic utere tuo ut alienum non laedus*); Moermond & Shirley, *supra* note 12, at 141 (quoting noted publicists who reject the principle); see also John A. Coghlin, *The All-American Canal Project Sparks Test Case for Transboundary Groundwater Law*, 14 B.C. INT'L & COMP. L. REV. 159, 166 n.199 (1991) (noting that the United States, in its recent dispute with Mexico over the All-American Canal Project, declined to apply the principle for legal as well as practical reasons); cf. Gleik, *supra* note 3, at 107 (asserting that virtually every international water treaty promulgated in the last century has rejected the Harmon Doctrine). But see Robert D.

tration,¹⁶ for example, the international tribunal concluded that upper riparian states are obligated to consider the rights and interests of lower riparian states, as well as to attempt to reconcile any disputes over water resource use or modification projects.¹⁷

2. Principle of Absolute Territorial Integrity

In sharp contrast to the principle of absolute territorial sovereignty, the principle of absolute territorial integrity provides that lower riparian states have the right to the continuous or natural flow of a river flowing from upper riparian states.¹⁸ Essentially, the principle permits upper riparians to exploit the waters of a river so long as such utilization does not affect the interests of lower riparians. In effect, lower riparian states receive a veto power or a monopoly over the water rights of upper riparian states.

This principle, like the principle of absolute territorial sovereignty, has received little support amongst legal publicists and in state practice.¹⁹ Indeed, no contemporary au-

Hayton, *Doman Colloquium on the Law of International Watercourses: Review of the ILC's Draft Rules on the Non-Navigational Uses of International Watercourses — Observations on the International Law Commission's Draft Rules on the Non-Navigational Uses of International Watercourses: Articles 1-4*, 3 COLO. J. INT'L ENVTL. L. & POL'Y 31, 35 (1992) (noting that many upper riparian states may still profess the attitude of "the river is mine").

16. *Lake Lanoux Arbitration (Fr. v. Spain)*, 24 I.L.R. 101 (Arbitral Tribunal 1957). The case between Spain and France, decided in 1957, concerned France's proposal to divert the waters of Lake Lanoux for hydroelectric purposes. Lake Lanoux feeds the Carol River which flows across the border from France to Spain. See Brunson MacChesney, *Judicial Decisions: Lake Lanoux Case (France v. Spain) 1957*, 53 AM. J. INT'L L. 156, 158 (1959).

17. See MacChesney, *supra* note 16, at 169. Significantly, though, the *Lake Lanoux* tribunal also found that upper riparian states are not obligated to involve lower riparian states in their water resource development projects. *Id.* at 170.

18. See Moermond & Shirley, *supra* note 12, at 142 (noting that the principle is the antithesis of the principle of absolute state sovereignty in that territorial sovereignty is permitted only to the extent that a state's actions may not cause harm to another state).

19. See Chenevert, Jr., *supra* note 6, at 504 (noting that the principle has never been embraced diplomatically nor espoused in any international adjudication).

thority espouses the postulate as a modern principle of international law.²⁰ It is regarded as inequitable in its allocation of water resources, as well as in its biased preference for downstream states, particularly because it does not require lower riparian states to compensate upstream states for preserving the waters.²¹

3. Principle of *Sic Utere Tuo Ut Alienum Non Laedas* and the Obligation Not to Cause Appreciable Harm

Customary international law obligates states not to use, or allow the use of, their territory for acts contrary to the rights of other states.²² This principle, often expressed as *sic utere tuo ut alienum non laedas*, receives wide recognition today as a general principle of international law.²³ It is applied in numerous international treaties,²⁴

20. Lipper, *supra* note 14, at 20.

21. See Chenevert, Jr., *supra* note 6, at 504 (asserting that the inequity of the principle originates in its underlying rationale of "allocation of rights without corresponding duties"); Lipper, *supra* note 14, at 67 n.6 (discussing cases where United States courts rejected the principle because of its inherently unfair nature that ignores the interests of the upstream state).

22. See Gretta Goldenman, *Adapting to Climate Change: A Study of International Rivers and Their Legal Arrangements*, 17 *ECOLOGY L.Q.* 741, 779 (1990) (stating that the principle of *sic utere* is part of customary international law); see also Moermond & Shirley, *supra* note 12, at 144 (noting that the principle is widely acknowledged as a basis for establishing state liability for harm caused to another state). Significantly, the principle does not apply to harm caused by "a natural state of affairs." Julio Barberis, *The Development of International Law of Transboundary Groundwater*, 31 *NAT. RESOURCES J.* 167, 171 (1991). International law does not require states to prevent harm to the territory of another state caused from "natural causes" originating within their territory. *Id.*

23. See Votava, *supra* note 3, at 232 (remarks of Stephen McCaffrey) (asserting that the "no appreciable harm rule" is substantiated by state practice).

24. *E.g.*, Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Mar. 22, 1989, 28 *I.L.M.* 649 (1989), 18 *I.L.M.* 1442 (1979), reprinted in *BASIC DOCUMENTS IN INTERNATIONAL LAW AND WORLD ORDER* (Second) 848 (Burns H. Weston et al. eds., 2d ed. 1990) (providing for the prevention and prohibition of harm to other states from the transport and disposal of hazardous wastes); Convention on Long-Range Transboundary Air Pollution, Nov. 13, 1979, reprinted in *BASIC DOCUMENTS IN INTERNATIONAL LAW AND WORLD ORDER* 732 (Burns H. Weston et al. eds., 2d ed. 1990) (providing, under "Fundamental Principles," for the prevention of transboundary harm caused by air pollution produced by Convention signatories);

declarations,²⁵ and other international instruments.²⁶ More-

Nordic Environmental Protection Convention, Feb. 19, 1974, Den.-Fin.-Nor.-Swed., art. 3, 13 I.L.M. 591, *reprinted in* INTERNATIONAL ENVIRONMENTAL LAW: PRIMARY MATERIALS 118 (Michael R. Molitor ed., 1991) (providing individual standing to pursue cases involving transboundary harm caused by other signatory countries); Agreement Between the Government of the Czechoslovak Republic and the Government of the Polish People's Republic Concerning the Use of Water Resources in Frontier Waters, Mar. 12, 1958, Czech.-Pol., art. 3, *reprinted in* INTERNATIONAL GROUNDWATER LAW 232 (Ludwick A. Teclaff & Albert E. Utton eds., 1981) (declaring that neither party to the agreement may, without the other's consent, commence activities which could affect the water utility of the other party); Agreement Between the Government of the Federal People's Republic of Yugoslavia and the Government of the Hungarian People's Republic Together with the Statute of the Yugoslav-Hungarian Water Economy Commission, Aug. 8, 1955, Yugo.-Hung., art. 1, *reprinted in* INTERNATIONAL GROUNDWATER LAW 236 (Ludwick A. Teclaff & Albert E. Utton eds., 1981) (providing for a cooperative arrangement in developing water resource exploitation projects which may affect the quantity or quality of the water in the watercourse).

25. *E.g.*, INSTITUTE OF INT'L LAW, MADRID DECLARATION ON INT'L REGULATIONS REGARDING THE USE OF INT'L WATERCOURSES FOR PURPOSES OTHER THAN NAVIGATION, 24 *Annuaire de l'Institut de Droit International* (1911), *reprinted in* MAJORIE M. WHITEMAN, DEP'T. OF STATE, 3 DIGEST OF INTERNATIONAL LAW 921 (1964) (prohibiting over-exploitation of a river which substantially affects the utility of the river to another state); Declaration of the United Nations Conference on the Human Environment, June 16, 1972, 11 I.L.M. 1416 (1972), *reprinted in* BASIC DOCUMENTS IN INTERNATIONAL LAW AND WORLD ORDER 372 (Burns H. Weston et al. eds., 2d ed. 1990) [hereinafter *Stockholm Declaration*] (providing in Principle Twenty-One that states have the sovereign right to exploit resources within their territory only to the extent that such exploitation does not harm the environment of another state); *Rio Declaration on Environment and Development*, U.N. GAOR Preparatory Comm., 4th Sess., Agenda Item 3, at 1, U.N. Doc. A/CONF. 151/PC/WG.III/L.33/Rev. (1992) [hereinafter *Rio Declaration*]. Most recently, the 1993 Rio Declaration on Environment and Development reaffirmed the precept. Principle Two reads as follows:

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

Id.

26. *E.g.*, *Charter of Economic Rights and Duties of States*, G.A. Res. 3281, U.N. GAOR, 29th Sess., Supp. No. 31, at 50, U.N. Doc. A/9631 (1975) (providing in Article Three of Chapter I, for cooperation in the exploitation of transboundary resources to prevent damage to each party's interests); *Draft Articles on the Law of Non-Navigational Uses of International Watercourses*, U.N. GAOR, 43d Sess., at 1, U.N. Doc. A/CN.4/L.463/Add.4 (1991) [hereinafter *ILC Draft Articles*] (asserting in Article Seven that states may not cause appreciable harm to the territory of another state through the use of an international water-

over, international project funding organizations, such as the World Bank, have indicated that they will not provide financial support for projects that are likely to cause appreciable harm to the territory of other states.²⁷

This principle was employed in the *Trail Smelter Arbitration*²⁸ which involved transboundary air pollution litigation between the United States and Canada.²⁹ In *Trail Smelter*, the tribunal concluded that states do not have the right to permit significant injury to the territory of other states through the use of their own territory.³⁰ Notably, although the case pertained to the release of noxious air pollutants, it is quite likely that the tribunal would have come to a similar conclusion were the injury effected through other forms of pollution, such as water contamination.³¹ It is further plausible that the tribunal would have agreed that the over-exploitation of an international water resource or the diversion of an international river could detrimentally affect another state's territory in violation of international law.³²

When considering whether one state's action causes, or

course); see also *Report of the United Nations Water Conference*, U.N. Doc. E/CONF.70/CBP/1 (1977); COMMISSION ON THE UTILIZATION OF NON-MARITIME INT'L WATERS, INSTITUTE OF INT'L LAW, SALZBURG RESOLUTION (1961), reprinted in MAJORIE M. WHITEMAN, DEP'T. OF STATE, 3 DIGEST OF INTERNATIONAL LAW 922 (1964).

27. See Votava, *supra* note 3, at 233 (remarks of Raj Krishna) (stating that the World Bank will not pursue projects that will harm the territory of another state unless requested by all interested parties to participate and suggest equitable apportionment).

28. *Trail Smelter Arbitration* (U.S. v. Canada), 3 R.I.A.A. 1911 (1941), reprinted in BASIC DOCUMENTS IN INTERNATIONAL LAW AND WORLD ORDER 358-59 (Burns H. Weston et al. eds., 2d ed. 1990).

29. *Id.* The case involved a smelter company, located on Canadian territory near the United States-Canadian border, whose toxic air emissions significantly polluted the air and environment in Washington State. *Id.*

30. *Id.* The holding specifically pertains to the emission of deleterious fumes. *Id.*

31. Lipper, *supra* note 14, at 30. "There could . . . be no doubt that the tribunal would have reached the same conclusion" if the injury was caused through other means of territorial use. *Id.*

32. *Id.* (asserting that diversion of an international river could seriously affect agricultural production and other industries of another state, and hence should result in a similar conclusion as that reached in *Trail Smelter*).

will cause, harm to the territory of another, a majority of international instruments and publicists suggest that the harm must be "appreciable" or "substantial" before international water law may be invoked.³³ For an injury to rise to the level of "appreciable" or "substantial" harm, the injury must have significant and consequential effects upon public health, economic productivity, or the environment of another state.³⁴ Analogously, the comment to Article Ten of the Helsinki Rules provides that "an injury is considered 'substantial' if it materially interferes with or prevents a reasonable use of the water."³⁵

4. Principle of Reasonable and Equitable Utilization

The principle of reasonable and equitable utilization is a utilitarian concept,³⁶ employing a cost-benefit analysis, which attempts to maximize the beneficial use of limited water resources while limiting the burdens.³⁷ It is grounded

33. See Hayton, *supra* note 15, art. 7 (asserting that states contiguous to international watercourses "shall" use such resources only in a manner that does not effect "appreciable harm" to other states bordering the watercourse); INTERNATIONAL LAW ASS'N, REPORT OF THE FIFTY-SECOND CONFERENCE, HELSINKI RULES ON THE USES OF THE WATERS OF INT'L RIVERS (1966), reprinted in BASIC DOCUMENTS IN INTERNATIONAL LAW AND WORLD ORDER 672-73 (Burns H. Weston et al. eds., 2d ed. 1990) [hereinafter HELSINKI RULES] (declaring in Article Ten that states should consider all reasonable measures and endeavor to minimize water pollution in an international drainage basin such that "substantial damage" is not caused to the territory of states contiguous to the drainage basin).

34. See Goldenman, *supra* note 22, at 780 (providing that for harm to be appreciable, there must be a "real impairment of use") (quoting *Report of the International Law Commission to the General Assembly*, GAOR, Supp. No. 10, ch. III, at 45, U.N. Doc. A/43/10 (1988)).

35. See ILA REPORT OF THE FIFTY-SECOND CONFERENCE, COMMENTS TO THE HELSINKI RULES ON THE USES OF THE WATERS OF INTERNATIONAL RIVERS (1966) [hereinafter COMMENTS TO HELSINKI RULES] reprinted in INTERNATIONAL LAW AND WORLD ORDER 327 (Burns H. Weston et al. eds., 2d ed. 1990).

36. See Lipper, *supra* note 14, at 43.

37. Chenevert, Jr., *supra* note 6, at 506. Of importance, maximizing beneficial use does not imply optimal use among all the watercourse riparians. See COMMENTS TO HELSINKI RULES, *supra* note 35, at 322 (asserting that beneficial use "need not be the most productive use . . . nor need it utilize the most efficient methods known in order to avoid waste and insure maximum utilization"). Rather, the uses employed must merely be beneficial in terms of the competing factors. *Id.* at 321 (noting that for a use to qualify under Article IV

on the principle of *sic utere tuo ut alienum non laedas*,³⁸ where detrimental consequences are not ultimately prohibited but rather weighed against the benefits gained.³⁹ Under this principle, each riparian state is entitled to a reasonable and equitable share in the beneficial uses of an international water resource.⁴⁰ This principle is widely accepted as a general rule of customary international law⁴¹ and applies to groundwater resources.⁴²

Significantly, the principle of reasonable and equitable utilization is an amalgamation of the principles of absolute territorial sovereignty and territorial integrity in that it recognizes and evaluates the shared and competing interests of all states embracing the watercourse.⁴³ The use of the re-

of the Helsinki Rules as beneficial, it must only be "economically or socially valuable").

38. Coghlin, *supra* note 15, at 180.

39. *See id.* (stating that the interests of the states concerned must be "fairly weighed in determining each state's rights to use transboundary water resources"). The ILC, however, has determined that where the no-harm rule is in conflict with the principle of equitable utilization, the no-harm rule supersedes. *See* Votava, *supra* note 3, at 235 (remarks of Stephen McCaffrey) (asserting that primacy of no-harm rule may be functional in protecting weaker states and states with little political power).

40. *See* Moermond & Shirley, *supra* note 12, at 149 (explaining that this entitlement is based on the degree to which equitable factors support a state's use of the particular resource).

41. *See* Lipper, *supra* note 14, at 62-63 (declaring that a great majority of authorities accept the principle of reasonable and equitable utilization). Already in 1958, at its Forty-Eighth Conference, the International Law Association adopted a Statement of Principles of International Law which states that where not expressly provided in a treaty or by customary norms, each state contiguous to an international watercourse "is entitled to a reasonable and equitable share in the beneficial uses of the waters of the drainage basin." INTERNATIONAL LAW ASSOCIATION, REPORT OF THE FORTY-EIGHTH CONFERENCE 67 (1958), reprinted in MAJORIE M. WHITEMAN, DEP'T OF STATE, 3 DIGEST OF INTERNATIONAL LAW 922 (1964) [hereinafter ILA REPORT OF FORTY-EIGHTH]; *cf.* Barberis, *supra* note 22, at 176 (noting that most comprehensive document on reasonable and equitable utilization of water resources is "Declaration of Principles on the Rational Use of Water," adopted by European Commission for Europe in 1984, (XXXIX) (1984)).

42. *See* Barberis, *supra* note 22, at 176 (noting that in the application of principle to groundwater, both the use and allocation of benefits must be reasonable).

43. *See* Goldenman, *supra* note 22, at 776. Goldenman also includes the principle of prior appropriation within the amalgamation, which provides those states that were first to use the water resources with a vested right to continue the use indefinitely. *Id.*; *see also* Lipper, *supra* note 14, at 44 (asserting that

source is determined by balancing competing social and economic factors of interested riparian states and by considering the physical aspects of an entire water resource system.⁴⁴ Under the Helsinki Rules⁴⁵ and the ILC Draft Articles,⁴⁶ relevant factors for consideration may include, *inter alia*: geographic, hydrologic, hydrographic, climatic and ecological circumstances; prior, existing, and potential uses of the waters; social and economic needs of each state; feasibility of alternatives to the proposed project; and compensation of one state as a means for resolving conflicts.⁴⁷

5. Principle of the Community of Interests

The community of interests theory goes a step beyond the principle of reasonable and equitable utilization in that it advances the goal of the most optimal use and development of a transboundary water resource system.⁴⁸ Fundamentally, this theory seeks to achieve economic efficiency and the greatest beneficial use possible, though often at the cost of equitable distribution and benefit among the states

equitable utilization is firmly grounded on the rationale of equality of rights to the extent that it balances the competing interests of all interested states).

44. See Moermond & Shirley, *supra* note 12, at 149. The 1977 United Nations Water Conference at Mar del Plata, for example, recommended that nations should properly appraise the rights and interests of other states sharing a common resource, when considering ways to exploit the resource within their territory, whereby the beneficial use of the resource is shared equitably among the states. Dante A. Caponera & Dominique Alhéritière, *Principles for International Groundwater Law*, 2 NAT. RESOURCE FORUM (1978) reprinted in INTERNATIONAL GROUNDWATER LAW 25, 50 (Ludwick A. Teclaff & Albert E. Utton eds., 1981). Article V (3) of the Helsinki Rules provides that, "In determining what is a reasonable and equitable share, all relevant factors are to be considered together and a conclusion reached on the basis of the whole." HELSINKI RULES, *supra* note 33, art. V (3). It is noteworthy that the Helsinki Rules do not provide further guidance as to how to evaluate individual factors relative to the other factors.

45. HELSINKI RULES, *supra* note 33.

46. ILC Draft Articles, *supra* note 26.

47. See HELSINKI RULES, *supra* note 33, art. IV (2); see also ILC Draft Articles, *supra* note 26, art. VI (1).

48. Chenevert, Jr., *supra* note 6, at 505. Applying the principle calls for a cooperative effort in the management of shared resources, including the sharing of costs for resource exploitation projects. See Lipper, *supra* note 14, at 39.

sharing the resource.⁴⁹ Furthermore, founded on the principles of "natural law," it ignores all national boundaries and regards the entire hydrologically connected water system as a single economic and geographic unit.⁵⁰

Of significance is the case of the *International Commission of the River Oder*.⁵¹ In deferring to principles of "international fluvial law,"⁵² the tribunal remarked that when considering transboundary water systems -- here, an international river -- and the desire to advance the principles of justice and utility,

[the] *community of interest in a navigable river becomes the basis of a common legal right*, the essential features of which are the perfect equality of all riparian States in the use of the whole course of the river and the exclusion of any preferential privilege of any one riparian State in relation to the others.⁵³

While the community of interests theory may be regarded as the most efficient and advantageous for the international management of shared transboundary natural resources,⁵⁴ its

49. Moermond & Shirley, *supra* note 12, at 153. For example, equitable and reasonable utilization would consider the extent of an aquifer underlying each countries' territory, and thus would determine that the reasonable quantity of water to be pumped by each state is proportionate to the area of water lying underneath each state. Barberis, *supra* note 7, at 51. Under the community of interests, on the other hand, a water-poor state adjacent to one with substantially more area of transboundary water resources would have a superior right of use over the water resources.

Under the Bellagio Draft Treaty, though, Article II provides that "the parties have entered into this Agreement in order to attain the optimum utilization and conservation of transboundary groundwater . . ." Hayton & Utton, *supra* note 3, at 682. Furthermore the comment to Article II asserts that under the Draft Treaty, "The objectives of 'optimal utilization and conservation' are agreed to be on a 'reasonable and equitable' basis . . ." *Id.* at 683. Under ideal conditions, the two principles appear to be reconcilable. Ideal conditions, however, are rarely the norm.

50. See Lipper, *supra* note 14, at 38-39 (noting that the community of interests principle is derived from "the practical consideration" that water resources rarely conform to the political divisions); see also Caponera & Alh  rit  re, *supra* note 44, at 51 (explaining that under this principle, water rights are vested in the entire watercourse community, irrespective of national boundaries).

51. Territorial Jurisdiction of the International Commission of the Oder River, 1929 P.C.I.J. (ser.A) No. 23, (Sept. 10).

52. *Id.* at 26.

53. *Id.* at 27 (emphasis added).

54. Caponera & Alh  rit  re, *supra* note 44, at 51. Lipper, however, notes

acceptance within the international community is sparse.⁵⁵

6. Principles of Prior Notice and Good Faith Negotiation

In considering the principles of *sic utere tuo ut alienum non laedas*, reasonable and equitable utilization, and community of interests, states are further obliged to notify other states prior to embarking on efforts to exploit transboundary water resources.⁵⁶ Furthermore, data and information must accompany the notification such that the notified state can objectively evaluate the project's potential effects.⁵⁷ Such communication is, in fact, essential for ascertaining whether a particular project will cause appreciable harm to water resources in the territory of another state, whether the project comports to reasonable and equitable utilization, or whether it promotes optimal use.⁵⁸ Thus, timely notification of exploitation projects, accompanied by sufficient technical

that the principle is applicable best where the interested parties are at similar stages of economic development. Otherwise, financial constraints of the lesser developed state could prevent optimal utilization. Compare Lipper, *supra* note 14, at 39 (pointing out financial difficulties which may hinder optimal utilization) with Moermond & Shirley, *supra* note 12, at 153-154 (noting that Helsinki Rules acknowledge the community of interests principle to the extent a state's financial resources permit).

55. Chenevert, Jr., *supra* note 6, at 505. The *Lake Lanoux* tribunal, for example, determined that an upper riparian state has no obligation to involve a lower riparian state in its development and planning of projects for the exploitation of transboundary resources. *Lake Lanoux Arbitration* (Fr. v. Spain), 24 I.L.R. 101, 140 (Arbitral Tribunal 1957). Notwithstanding, at least one publicist considers the concept as a progressive and prescience development in international water law. Cohen, *supra* note 13, at 524-25. The principle was also incorporated as the fundamental goal of the Bellagio Draft Treaty. Hayton & Utton, *supra* note 3, at 668. The preamble of this Draft Treaty provides that "optimum and efficient use" of international water resources is fundamental to the agreement and is an advantage to all parties concerned, while Article II, paragraph 2, provides that the contracting parties accept the agreement so as to realize "optimum utilization and conservation of transboundary groundwater" *Id.* at 676, 682.

56. Barberis, *supra* note 22, at 178-79.

57. *Id.* at 178 (pointing out that the data relayed must be timely and sufficient such that the notified state can evaluate the possible effects of the project); see also Gleik, note 3, at 108 (noting that obligation to exchange information is widely accepted, except where it is deemed classified); *Rio Declaration*, *supra* note 25, princ. 19; *ILC Draft Articles*, *supra* note 26, art. 12.

58. Barberis, *supra* note 22, at 178.

information, is regarded as a recognized principle of international law.⁵⁹

In the event that the notified state's analysis suggests that substantial harm will result from the notifying state's actions, or a dispute arises based on opposing conclusions, the states involved have an obligation to jointly verify the findings and to attempt to reach an acceptable solution.⁶⁰ Of particular importance, such consultations and discussions must be conducted in good faith and with the intention of achieving a resolution acceptable to all concerned.⁶¹ Specifically, any deliberation commenced because of a dispute over the exploitation of transboundary resources must be a sincere intention towards an amicable solution in order to promote trust and cooperation amongst the parties.⁶²

59. *See id.* at 179 (contending that obligation is a customary rule of international law as well as a principle generally recognized in international environmental law); *see also* Ludwik A. Teclaff & Eileen Teclaff, *Transboundary Groundwater Pollution: Survey and Trends in Treaty Law*, in *INTERNATIONAL GROUNDWATER LAW* 77, 110 (Ludwik A. Teclaff & Albert E. Utton eds., 1981) (asserting that "[t]here is no longer any question that modern treaty practice incorporates the duty to exchange information and to notify other states of plans, projects and activities that may affect them adversely").

60. Robert D. Hayton, *The Present State of Research Carried Out by the English-Speaking Section of the Centre for Studies and Research*, in *CENTRE FOR STUDIES AND RESEARCH IN INTERNATIONAL LAW AND INTERNATIONAL RELATIONS: RIGHTS AND DUTIES OF RIPARIAN STATES OF INTERNATIONAL RIVERS* 59, 78 (1990). The international tribunal in the *Lake Lanoux Arbitration* found this obligation to be a part of customary international law. The Tribunal averred that though the scope and form of the negotiations may vary, the reality of the obligations thus undertaken is incontestable and sanctions can be applied in the event, for example, of an unjustified breaking off of the discussions, abnormal delays, disregard of the agreed procedures, systematic refusals to take into consideration adverse proposals or interests, more generally, in cases of violation of the rules of the rules of good faith.

Lake Lanoux Arbitration (Fr. v. Spain), 24 I.L.R. 101, 128 (Arbitral Tribunal 1957). *See* Barberis, *supra* note 22, at 181 (noting that the International Court of Justice recognized the obligation to negotiate as a fundamental principle underlying international law in *North Sea Continental Shelf* (F.R.G. v. Denmark; F.R.G. v. Netherlands), 1969 I.C.J. 2, 47).

61. *See Lake Lanoux Arbitration* (Fr. v. Spain), 24 I.L.R. 101, 139 (Arbitral Tribunal 1957) (noting that upper riparian state is obligated, "according to the rules of good faith," to consider interests of other riparian states when embarking on project to exploit transboundary resources); *see also Rio Declaration*, *supra* note 25, princ. 19 (asserting that states must negotiate in good faith).

62. *See ILC Draft Articles*, *supra* note 26, art. 17 (2) (advising states to

An indispensable facet of good faith negotiations requires the notifying state not to proceed with the planned activity, or to suspend progress of the activity, until such time as the dispute is resolved.⁶³ Especially in cases involving transboundary resource exploitation projects, states developing such projects must refrain from proceeding with the plans until such time as a compromise is achieved between the interested parties, or as may be considered a "reasonable" period of time.⁶⁴

B. Groundwater and its Relationship to Surface Water

Groundwater is found primarily in aquifers⁶⁵ — porous layers of soils (such as sand or gravel) that act as natural storage systems and media of conveyance⁶⁶ — which are

consult and negotiate "on the basis that each state must in good faith pay reasonable regard to the rights and legitimate interests of the other state"); *see also* Barberis, *supra* note 22, at 181 (stating that "[t]he parties concerned should engage in real negotiations and not a mere exchange of written communications or talks designed to superficially comply with the requirements. . . . States must conduct themselves so that the negotiation is meaningful"). One publicist, however, notes that this obligation does not suggest that a resolution of the dispute must be achieved, but merely that the parties negotiate towards that objective in good faith. *See* MacChesney, *supra* note 16, at 166 (asserting that duty of prior notification does not include duty to achieve a compromise with the state notified).

63. *See* Dante A. Caponera, *Patterns of Cooperation in International Water Law: Principles and Institutions*, 25 NAT. RESOURCES J. 563, 569 (1985) (noting that this duty is increasingly required as part of the obligation to cooperate in transnational development initiatives).

64. *See* ILC Draft Articles, *supra* note 26, at 6 (asserting in Article Seventeen (3) that in the course of such discussions, notifying State "shall, if so requested by the notified State," refrain from proceeding with planned project for period of up to six months).

65. Barberis, *supra* note 22, at 167. Aquifers are geologic formations that are permeable enough to store and transmit usable quantities of water. *See* BOUWER, *supra* note 7, at 3 (describing aquifers); PRICE, *supra* note 7, at 65-87 (offering a basic understanding of different types of aquifers and their physical properties).

66. *See* Barberis, *supra* note 7, at 4 (giving general description of different types of groundwater aquifers). The porous layer of aquifers typically overlay the non-porous stratum, a basement layer through which little if any water filters through, creating a natural water reservoir. *Id.* The upper limit of the saturated area of the reservoir is known as the water table. *Id.* at 3. *See also* Gyorgy Kovacs, *The Use of Groundwater Resources in River Basin Development*, in RIVER BASIN DEVELOPMENT: POLICIES AND PLANNING 138, 140 (1975)

replenished mainly from atmospheric precipitation infiltrating through the soil.⁶⁷ As water tends to flow with gravity,⁶⁸ aquifers are often replenished from surface water sources⁶⁹ and other aquifers,⁷⁰ and can supply still other surface waters and underground aquifers.⁷¹ That is not to say that all aquifers are interconnected to surface bodies of water.⁷² It is rare, however, that an international river is not somehow linked to a groundwater source.⁷³ Where a hydrological link exists, a causal relationship can be established between surface and groundwater, and any natural or human-caused occurrence affecting one section of the water system will likely affect the quantity, quality or potential economic value of a water source in another section.⁷⁴

(providing technical/scientific description and explanation of groundwater aquifers).

67. BOUWER, *supra* note 7, at 6. Water percolates through the strata until it reaches an impermeable base layer such as clay or shale, at which point it flows laterally. *Id.*; cf. BOWEN, *supra* note 7, at 152 - 54 (discussing rainfall effects on groundwater levels).

68. See HEATH, *supra* note 7, at 20 (noting that gravity is the dominant force affecting groundwater movement). On a more technical level, subsurface water movement is a function of hydraulic gradient — the slope between areas of high hydraulic potential and areas of low hydraulic potential. *Id.* See Barberis, *supra* note 7, at 2. Water generally flows from high to low hydraulic potentials. *Id.* The rate of water-flow through the porous media is controlled by permeability of the soils as well as hydraulic gradient. See Bouwer, *supra* note 7, at 89-101 (explaining technical aspects of rate and direction of flow in groundwater); see also HEATH, *supra* note 7, at 20-25 (discussing the flow and velocity of groundwater and methods for charting such movement).

69. Barberis, *supra* note 7, at 2. (noting that aquifers may be recharged from rivers, lakes and melting snow and glaciers, as well as from human activities such as irrigation operations, dike and canal building, and damming projects); see BOUWER, *supra* note 7, at 252, 268-70 (discussing the cross-flow of water between surface and underground water resources and explaining that water may seep from a stream into an aquifer where the groundwater level is below the water level of the stream).

70. See Barberis, *supra* note 7, at 5 (noting that an aquifer may be recharged by an aquifer located across a political boundary).

71. *Id.* at 5-6. An aquifer with groundwater level above a nearby stream or lake, in terms of elevation, may be a source for that surface body of water. *Id.* It is also possible for one aquifer to feed another. *Id.*; cf. BOUWER, *supra* note 7, at 293-306 (discussing means by which water may flow out of an aquifer).

72. See Barberis, *supra* note 7, at 4 (describing different types of aquifers, including confined aquifer which may be completely unconnected to any other surface or underground body of water).

73. See Teclaff & Teclaff, *supra* note 59, at 78.

74. See Barberis, *supra* note 7, at 38 (asserting that changes in the course

Generally, both groundwater and surface waters traverse national borders and political boundaries without opposition.⁷⁵ Groundwater aquifers can span international boundaries or may be part of a greater hydrologic system linked with the surface or groundwater of neighboring states.⁷⁶ Consequently, the actions of one state, in connection with an international river or groundwater aquifer, may deleteriously affect the quality or quantity of water in another state.⁷⁷

Water pollution is generally defined as any direct or indirect effect upon the composition, content or quality of water, resulting from human activity,⁷⁸ that is detrimental

of flow of a river can cause the depletion of an interconnected aquifer); Teclaff & Teclaff, *supra* note 59, at 78 (noting that because of the interrelationship between surface and groundwater, pollution of one of these water sources will likely affect all interconnected water sources); Barberis, *supra* note 22, at 169 (noting that a groundwater aquifer may be depleted as a result of a change in an interconnected river's natural course).

75. See Utton, *supra* note 6, at 26 (asserting that "groundwater, like surface water, knows no political boundaries"); see also Goldenman, *supra* note 22, at 774 (declaring that "[p]olitical boundaries rarely correspond to natural formations and rivers do not generally respect national borders").

76. Barberis, *supra* note 22, at 168. Barberis describes four cases in which groundwater may be linked to a water system shared between a number of states: 1) an aquifer traversing an international border which is itself the shared water resource; 2) an aquifer located within one state but hydrologically connected with an international river, the river being the shared resource; 3) an aquifer located within one state but hydrologically linked (possibly through semi-permeable stratum) to an aquifer found within another state, thus making the entire formation a shared system; and 4) an aquifer located within one state with a recharge area found within another state, as in mountainous regions, whereby the water in the recharge area is the shared resource. *Id.* The importance of identifying these distinct cases becomes readily apparent when considering shared water systems and the causal relationship that actions taken in one part of the water system can have on another part.

77. Cf. RESTATEMENT (THIRD) OF FOREIGN RELATIONS LAW pt. VI, Introductory Note (1987) [hereinafter RESTATEMENT]. The Restatement asserts that transfrontier pollution may occur where the environment or the inhabitants of one state are harmed as a result of activities in another state. *Id.*

78. See Barberis, *supra* note 22, at 172 (remarking that the human element appears to be a necessary component of the definition of water pollution, thus leaving "naturally" caused contaminations outside the scope of the meaning); see also Charles Odidi Okidi, *Doman Colloquium on the Law of International Watercourses: Review of the ILC's Draft Rules on the Non-Navigational Uses of International Watercourses — "Preservation and Protection" Under the 1991 ILC Draft Articles on the Law of International Watercourses*, 3 COLO. J. INT'L ENVTL. L. & POL'Y 143, 157 (1992) (questioning whether human element in

to human health or to the health of the environment.⁷⁹ Such pollution can affect both surface⁸⁰ and underground water⁸¹ sources and can result from the infiltration of contaminants from sewage, industrial wastes, pesticides, and other man-made materials.⁸²

the definition of water pollution is a necessary limitation).

79. See *The International Law Association, Montreal Rules of International Law Applicable to Transfrontier Pollution*, Sept. 4, 1982, art. 2, No. 1. (defining pollution as "any introduction by man, directly or indirectly, of substance or energy into the environment resulting in deleterious effects of such a nature as to endanger human health, harm living resources, ecosystems and material property and impair amenities or interfere with other legitimate uses of the environment"); see also HELSINKI RULES, *supra* note 33, art. IX, at 673 (defining water pollution as "any detrimental changes resulting from human conduct in the natural composition, content, or quality of the waters"); cf. Joanne Linnerooth, *The Danube River Basin: Negotiating Settlements to Transboundary Environmental Issues*, 30 NAT. RESOURCES J. 628, 639 (noting that the trend in the scientific community is to broaden the definition and scope of water pollution to include the interrelationship of surface and groundwater). Environment, in this case, is defined as all living resources and the ecosystems in which they are found.

80. See Anthony Lester, *Pollution*, in *THE LAW OF INTERNATIONAL DRAINAGE BASINS* 15, 22 (Garretson et al. eds., 1967) (considering water pollution in the context of international drainage basins and the legal regime governing the prevention of such pollution).

81. See generally Teclaff & Teclaff, *supra* note 59, at 78 (commenting on groundwater pollution and the development of treaty law preventing such occurrences).

82. See Barberis, *supra* note 22, at 173 (noting human related causes of groundwater pollution); BOWEN, *supra* note 7, at 208-11 (discussing various sources of groundwater pollution). The World Resources Institute describes the three primary types of freshwater pollution: 1) oxygen depletion caused by algae blooms which thrives on nutrient rich sewage and soil erosion; 2) disease carrying pathogens spread by sewage; and 3) industrial pollutants, heavy metals, and synthetic organic compounds which bioaccumulate in aquatic organisms. WORLD RESOURCES 1992-93, *supra* note 1, at 161-62, 167-69 (describing sources and impacts of fresh water pollutants). Sources for these pollution types include: sewage disposal, industry and mining waste, agricultural runoff, and overgrazing and deforestation. *Id.* at 167-169.

It is noteworthy that groundwater pollution is often much more serious than the contamination of surface water. See Utton, *supra* note 6, at 14; see also Teclaff & Teclaff, *supra* note 59, at 78-79 (discussing sources of groundwater pollution and noting that due to the extent of surface water pollution, aquifers interconnected with lakes, streams and other surface bodies of water are more apt to become polluted than those which are isolated from other water sources). In contrast to surface waters which tend to have the ability to be self-cleaning, groundwater tends to accumulate pollution. Teclaff & Teclaff, *supra* note 59, at 80. The more rapid flow from rain or river water cleanses contaminants from polluted surface waters or dissipates them into less harmful concentrations. Groundwater, on the other hand, acts as a storage basin for pollution

The causes of water pollution, however, are not limited to the introduction of contaminants. Human activities themselves (as opposed to the resulting effects, i.e., contamination), may also adversely affect water quality, content, and supply, regardless of whether the activities are directly or indirectly related to the water system.⁸³ Over-exploitation of a water source, for example, in excess of the rate of recharge, can harm the future viability and productivity of the water source.⁸⁴ Likewise, tampering with or modifying the source of a river, or of the natural recharge area of a river, can deleteriously affect the volume and rate of flow of the water, thus increasing the settling of particles onto the river bed.⁸⁵ Irrigation practices, for example, may increase the salinity content of rivers.⁸⁶

In addition, due to the interrelationship between surface and underground water resources, it is quite likely that activity detrimental to the quality or quantity of one of

due to the relatively contained nature of the aquifer as well as to the sluggish flow of the water. *Id.* at 78-80. Contamination of groundwater is often irreversible or is exceptionally difficult to remedy. *See id.* at 80-81 (explaining that contaminated groundwater aquifers may require one hundred years of constant recharge in order to bring it to a standard acceptable for human consumption).

83. Barberis, *supra* note 22, at 169-170 (noting that aquifer impairment may be caused by changes to the geological structure of the aquifer as can occur from underground nuclear testing and from over-exploitation of deep-lying aquifers thus causing subsidence); *Cf.* RESTATEMENT, *supra* note 77, pt. VI, Introductory Note (asserting that activities such as erecting a dam or irrigation field, may harm the surrounding environment).

84. *See* Barberis, *supra* note 7, at 11 (noting that over-exploitation of groundwater aquifer can lower water table rendering aquifer depleted); *see also* Barberis, *supra* note 22, at 172 (remarking that overdrawing from a fresh water aquifer located adjacent to a salt-water coast may cause intrusion of saline water into the aquifer).

85. *Cf.* Lester, *supra* note 80, at 91 (noting that mining industries near river systems can increase the particle load of a stream causing silting which in turn can harm the aquatic life of the river and reduce the self-purification abilities of the river bed). An increase in the amount of settled particles on a river bed can reduce the porous capacity of the bed, thus reducing the volume of water which percolates to groundwater aquifers. *See* Interview with Jozsef Deak, Geophysicist with Water Resources Research Centre of Hungary, in Washington, D.C. (October 23, 1993) (on file with author) [hereinafter Deak Interview]. It can also decrease the filtering abilities of the river bed to minimize the infiltration of industrial pollutants, heavy metals, and other types of contaminant normally suspended in the water by the volume and flow of the river. *Id.*

86. RESTATEMENT, *supra* note 77, pt. VI, Introductory Note.

these water resources will manifest in interconnected water resources.⁸⁷ Over-exploitation of groundwater aquifers in coastal areas may cause salt water intrusion;⁸⁸ mining of mineral resources can contaminate area groundwater;⁸⁹ development of dams and water-works projects may affect regional groundwater levels and increase river silting;⁹⁰ and the diversion of a river from its natural course can deplete or pollute interconnected groundwater aquifers.⁹¹

C. Groundwater in International Water Law

Until quite recently, the international legal regime regulating the use of international waters neglected the importance of groundwater resources.⁹² Within the academic arena the

87. See Teclaff & Teclaff, *supra* note 59, at 79 (explaining that water pollution can travel between surface and groundwater resources that are interconnected).

88. See BOUWER, *supra* note 7, at 402-06 (discussing seawater intrusion into fresh water aquifers and the process of upconing — excessive pumping of a freshwater well in areas close to the freshwater/saltwater interface causing underlying salt water to rise and enter the well); see also Barberis, *supra* note 22, at 172.

89. See BOUWER, *supra* note 7, at 432-35 (explaining the effect residue from various mines can have on groundwater quality); BOWEN, *supra* note 7, at 209 (discussing effects of certain minerals like coal, copper, phosphate, iron, and other substances on groundwater).

90. See Teclaff & Teclaff, *supra* note 59, at 79 (stating that “[t]he development of water-works — dams, canals, drainage ditches and pipes, and works for hydroelectric power production — in itself may be a cause of groundwater pollution”); see also RESTATEMENT, *supra* note 77, pt. VI, Introductory Note (noting that the construction of a dam may cause erosion); cf. Deak Interview, *supra* note 85 (explaining that because the Szigetköz aquifer heavily depends on water seeping from the Danube River, damming the river will likely cause river bed silting, thus affecting the volume of water filtering through the soil and the region’s groundwater levels).

91. See Barberis, *supra* note 22, at 169 (asserting that changes in the course of a river can eventually deplete an interconnected aquifer); cf. Teclaff & Teclaff, *supra* note 59, at 79 (commenting that the diversion of surface waters can detrimentally affect interconnected aquifers).

92. See Teclaff & Teclaff, *supra* note 59, at 84 (contending that “[b]ecause groundwater pollution is out of sight it is also out of mind”); Caponera & Alh  rit  re, *supra* note 44, at 26 (contending that most legal research, until recently, was directed towards matters pertaining to surface water while legal regime for transboundary waters ignored groundwater issues); Utton, *supra* note 6, at 4 (noting that national as well as international legislation, pertaining to groundwater, is sorely deficient).

subject received little attention and only minimal legal treatment.⁹³ Some publicists ascribe this neglect to a "hydroschizophrenia" — a condition attributed to certain decision-makers who misunderstand the relationship of, and differentiate between, surface and groundwater.⁹⁴ The root of the problem, however, appears to lie in the fact that modern legal systems offer reactionary responses to individual situations rather than offering a proactive means to prevent such predicaments.⁹⁵ In other words, international law invariably lags behind the pace and development of modern society and thus is often inadequately equipped to deal with contemporary predicaments.⁹⁶

In recent years, the international legal community has sought to catch up with contemporary science — to consider the hydrologic system as a whole and to acknowledge the indissociable nature of surface and groundwater.⁹⁷ Of

93. See Caponera & Alh  riti  re, *supra* note 44, at 25-26 (contending that most past research into international water law regarded surface water and ignored groundwater).

94. See *id.* at 30 (noting that this condition is manifest in the numerous projects affecting water resources that employ fundamentally disparate principles and policies for groundwater and surface water bodies).

95. See Hayton, *supra* note 8, at 60 (noting that legal and political systems do not anticipate needs of society but rather respond to needs only after they are manifest); see also Lipper, *supra* note 14, at 22. Lipper suggests that the creation or progressive development of law is a direct reactionary response to the changing needs of society, hence perpetuating the evolution of the law. Lipper, *supra* note 14, at 22. Although the need may manifest itself before a crisis emerges, society as a whole rarely if ever comes to demand proactive legislation. *Id.* Consequently, the oft joked-about maxim that the law trails scientific discovery by ten to twenty years or more seems to still hold true today.

96. See *id.*; cf. Stephen McCaffrey, *International Organizations and the Holistic Approach to Water Problems*, 31 NAT. RESOURCES J. 139, 150 (1991) (asserting that the law must keep pace of scientific discoveries, and must adapt to new innovations, as science develops and operates on the frontiers of knowledge). As noted in Judge Lach's dissenting opinion in the *North Sea Continental Shelf*, "the acceleration of social and economic change, combined with that of science and technology, have confronted law with a serious challenge: one it must meet, lest it lag even farther behind events than it has been wont to do." *North Sea Continental Shelf* (F.R.G. v. Den.; F.R.G. v. Neth.), 1969 I.C.J. 472 (Feb. 20).

97. See, e.g., Hayton, *supra* note 60, at 61, 64 (asserting that "[t]he increasingly extolled 'hydrologic cycle' finally showed signs of being comprehended in its complete rather than in its segmented form" and that international acceptance and acknowledgement of the interrelationship and interdependence between sur-

particular significance in adapting to meet modern science is the work of international organizations responsible for the codification of international customary law as it relates to transboundary waters.⁹⁸ Most noteworthy of these organizations are the International Law Association and the International Law Commission, whose work is discussed below.

1. *Work of the International Law Association*

One of the earliest explicit recognitions of the interrelationship of surface and groundwater came in a statement of principles at the forty-eighth Conference of the International Law Association ("ILA") in 1958.⁹⁹ Under the title of

face and groundwater was a "cutting edge development"); Utton, *supra* note 6, at 14 (asserting that a principle legal development in international water law is the acknowledgement of the relationship of surface and groundwater); Caponera & Alh riti re, *supra* note 44, at 55 (asserting that it is logical and appropriate to transplant legal regime of surface water law to that of underground waters on "basis of a *de facto* connection" between the two types of water resource, as both sources are a dissociable part of the hydrologic cycle); *see also* Barberis, *supra* note 22, at 186 (contending that although groundwater protection has only recently become an issue of international concern, it should be subject to the same legal regime applicable to other international shared resources); Utton, *supra* note 11, at 178-80 (noting that to effectively manage transboundary groundwater resources, "it is essential to recognize the interrelationship between surface and groundwater"); *cf.* Kovacs, *supra* note 66, at 139 (asserting that in scientific terms, surface and groundwater resources are indissociable — "there is only one unit of water resource").

98. *See, e.g.,* HELSINKI RULES, *supra* note 33, at 672 (providing in Article II that the International Law Association recognizes "[a]n international drainage basin [as] the entire area, known as the watershed, that contributes water, both surface and underground, to the principle river, stream or lake or other common terminus"); John A. Coghlin, *All-American Canal Project Sparks Test Case for Transboundary Groundwater Law*, 14 B.C. INT'L & COMP. L. REV. 189 n.199 (1991) (asserting in Article Two, entitled "Hydraulic Interdependence," that "[a]n aquifer that contributes water to, or receives water from, surface waters of an international basin constitutes part of that international basin for the purpose of the Helsinki Rules"); ILC Draft Articles, *supra* note 26, at Article II(b) (defining "watercourse" for the International Law Commission as "a system of surface and underground waters constituting by virtue of their physical relationship a unitary whole").

99. ILA REPORT OF FORTY-EIGHTH, *supra* note 41, at 924-26. The International Law Association, founded in 1873, is a private non-governmental organization tasked with the development and codification of international law. *See* McCaffrey, *supra* note 96, at 141-50 (giving a more substantive history of the work of the ILA, pertaining to the law of international water resource).

"Agreed Principles of International Law," the comment to Principle One provided that although international law heretofore focused predominantly on surface water sources, it is essential to give due regard to all of the interdependent hydrological features of a drainage basin.¹⁰⁰ Thereafter, in 1966, the ILA adopted the organization's seminal work, the Helsinki Rules on the Uses of International Waters of International Rivers ("Helsinki Rules").¹⁰¹ Drafted by the ILA Committee on the Uses of the Waters of International Rivers,¹⁰² the set of articles represented one of the earliest attempts at codifying customary international law pertaining to transboundary water resources.¹⁰³ Significantly, Article II of the Helsinki Rules defines an international drainage basin,¹⁰⁴ the unit used to delineate the geographic scope considered under the Rules, as a transboundary geographic area defined by the extent of the watershed, "including surface and groundwater."¹⁰⁵

The Association later adopted the Seoul Groundwater Rules at the 1986 Seoul Conference of the ILA¹⁰⁶ expanding the Helsinki Rules as they relate to transboundary

100. ILA REPORT OF FORTY-EIGHTH, *supra* note 41, at 924.

101. HELSINKI RULES, *supra* note 33.

102. See McCaffrey, *supra* note 96, at 141. In 1966, this committee was replaced by the Committee on International Water Resource Law. All subsequent work pertaining to the law of international water resources was drafted by this committee. *Id.* at n.9.

103. See *id.* at 141.

104. HELSINKI RULES, *supra* note 33, art. II. The evolution of the legal terminology defining the geographic region of interrelated surface and groundwater, as considered under the scope of international water law, has been somewhat controversial. The dispute centered on the physical extent of the region encompassed within the term. While international instruments have used "drainage basin," "water resource system," and "watercourse system" over the years, the phrase "watercourse" appears to be the currently accepted term. See generally Articles 1-4, *supra* note 15, at 35-37.

105. HELSINKI RULES, *supra* note 33. Moreover, the comment to Article II provides that, "[t]he drainage basin is an indivisible hydrologic unit which requires comprehensive consideration in order to effect maximum utilization and development of any portions of its waters" INTERNATIONAL LAW ASS'N, REPORT OF FIFTY-SECOND CONFERENCE, COMMENTS TO THE HELSINKI RULES ON USES OF THE WATERS OF INTERNATIONAL RIVERS, reprinted in Stephen McCaffrey, *International Organizations and the Holistic Approach to Water Problems*, 31 NAT. RESOURCES J. 139, 141 (1991).

106. Coghlin, *supra* note 98.

groundwater resources.¹⁰⁷ Paragraph Three of Article Two, entitled "Hydraulic Interdependence," provides that under the laws and duties of international law, states contemporaneous with a drainage basin must consider the interdependence of "groundwater and other waters, including any interconnections between aquifers"¹⁰⁸ The inclusion of groundwater within the definition of drainage basin, and the obligation to give due regard to international groundwater resources, thus affirms the premise that groundwater is subject to contemporary international water law.

2. *Work of the International Law Commission*

In 1991, the United Nation's International Law Commission ("ILC") adopted the Draft Articles on the Non-Navigational Uses of International Watercourses ("ILC Draft Articles")¹⁰⁹ on its first reading.¹¹⁰ The ILC Draft Articles constitute a framework agreement¹¹¹ intended to assist nations in developing watercourse agreements as well as in solving disputes over international water resources in the absence of existing agreements.¹¹²

107. See Coghlin, *supra* note 15, at 189 (asserting international water law was expanded by the explicit inclusion of groundwater resources within framework and definition of an international watercourse).

108. See Coghlin, *supra* note 98, at 189 n.199.

109. *ILC Draft Articles*, *supra* note 26. The International Law Commission, established by the United Nations General Assembly in 1947, is charged with the interpretation, codification, and development of international law. McCaffrey, *supra* note 96, at 150. In 1970, the General Assembly of the United Nations recommended that the ILC research the law of non-navigational uses of international watercourses and codify their findings. The ILC Draft Articles are the work product of the Commission. Chenevert, Jr., *supra* note 6, at 496; see McCaffrey, *supra* note 96, at 150-161 (giving a more substantive history of the work of the ILC on law of the non-navigational uses of international watercourses).

110. Stephen McCaffrey, *Current Developments: The Forty-Third Session of the International Law Commission*, 85 AM. J. INT'L L. 703, 703 (1991).

111. See *ILC Draft Articles*, *supra* note 26, art. III (providing that states entering into watercourse agreements "apply and adjust the provisions of the present articles to the characteristics and uses of a particular international watercourse"); see also *Articles 1-4*, *supra* note 15, at 41 (noting that the Articles are designed as guidelines for negotiations).

112. See Goldenman, *supra* note 22, at 773 (noting that the rules were in-

Article Two of the ILC Draft Articles defines "water-courses," the unit used to describe the geographic extent considered in the Articles, as "a system of surface and underground waters *constituting by virtue of their physical relationship a unitary whole . . .*"¹¹³ In recognizing that the two sources of water constitute a part of a unitary whole, by virtue of the physical interrelationship, the ILC acknowledged the fact that groundwater is governed by international water law.¹¹⁴ Moreover, as the ILC Draft Articles are based on state practice, existing international agreements, and other potential sources of international law,¹¹⁵ they are regarded as obligatory and operative insofar as they codify current customary international law.¹¹⁶

3. *Work of Other International Organizations*

In reviewing drafts and recommendations pertaining to international water law, there appears to be widespread acceptance and recognition among international organizations that international watercourse systems must be considered and treated as a unitary whole. Moreover, it becomes more apparent within the legal community, as well as among the many international bodies regulating water resources, that attempting to isolate one aspect of the hydrologic cycle, when considering modern water issues, is an exercise in futility.¹¹⁷ A few representative examples of such drafts

tended to be specific such that they would ensure an adequate framework for the protection of all interested states' rights).

113. *ILC Draft Articles*, *supra* note 26, at 2 (emphasis added).

114. Coghlin, *supra* note 15, at 187.

115. See Goldenman, *supra* note 22, at 773. In addition, in an effort to adapt to scientific discoveries, the ILC makes an effort to consider new principles applicable to international water resources, as well as to develop new concepts where appropriate. *Id.*

116. Chenevert, Jr., *supra* note 6, at 509 n.80. Further, Gretta Goldenman asserts that the ILC's draft regulations are regarded by the international legal community as having a quasi-legal nature, even before they are ratified by the U.N. General Assembly. Goldenman, *supra* note 22, at 773.

117. See McCaffrey, *supra* note 96, at 161 (arguing that omission of groundwater resources from jurisdiction of international water law leaves the whole legal regime of transboundary water shallow and ineffectual, unable to address

and recommendations are briefly discussed below.

The European Economic Community ("EEC") has enacted several directives aimed at the protection of the Community's water resources, that consider groundwater under the aegis of international water law. For example, EEC Council Directive 80/778 relating to the Quality of Water Intended for Human Consumption, provides in Article Two that "water intended for human consumption," as considered in the directives, is defined as any water used for that purpose, regardless of its origin.¹¹⁸ Likewise, Article One of EEC Council Directive 76/464 on Pollution Caused by Certain Dangerous Substances Discharged into the Aquatic Environment of the Community provides that the Directive pertains to all sources of water including "inland surface water, territorial waters, internal coastal waters, [and] ground water."¹¹⁹

The United Nations Economic Commission for Europe ("ECE"), in a 1986 report on groundwater legislation in the ECE region, concluded that "the interrelationships between surface and groundwater are various, frequently pervasive and of great practical significance."¹²⁰ The ECE Report endorsed the principle that greater efficiency in use, storage and conservation, as well as improved overall administration

and resolve contemporary transboundary water disputes, especially in light of growing world-wide demand and competition for limited resources); *U.S.-Mexican Frontier*, *supra* note 11, at 178 (asserting that legal, as well as physical, distinctions between surface and groundwater are "[c]ontrary to hydrologic reality").

118. Council Directive 80/778, art. 2, of 15 July 1980 Relating to the Quality of Water Intended for Human Consumption, 1980 O.J. (L 229) 1, *amended by* Directive 81/858 consequent upon the Accession of Greece, 1981 O.J. (L 319) 19, *and the Act of Accession of Spain and Portugal of 12 June 1985*, 1985 O.J. (L 302) 9, *reprinted in* EUROPEAN COMMUNITY DESKBOOK 245-49 (1992).

119. Council Directive 76/464 of 4 May 1976 on Pollution Caused by Certain Dangerous Substances Discharged into the Aquatic Environment of the Community, 1976 O.J. (L 129) 23, *reprinted in* EUROPEAN COMMUNITY DESKBOOK 264, 265 (1992); *cf.* Council Directive 80/68 of 17 December 1979 on the Protection of Groundwater Against Pollution Caused by Certain Dangerous Substances, 1980 O.J. (L 20) 43, *reprinted in* EUROPEAN COMMUNITY DESKBOOK 322 (1992) (superseding Council Directive 76/464 with respect to groundwater).

120. Hayton & Utton, *supra* note 3, at 680 (quoting *Groundwater Legislation in the ECE Region*, ECE Doc. ECE/Water/44 (1986)).

of water resources could be achieved through an integrated approach in the management of surface and groundwater resources.¹²¹ In addition, the ECE Charter on Ground-Water Management¹²² asserts that groundwater protection policies should be included within the rubric of comprehensive environmental protection strategies since groundwater pollution is inevitably interrelated and interconnected not only to other water resources, but also to the environment as a whole.¹²³

The Bellagio Draft Treaty,¹²⁴ which developed out of the United States-Mexican dispute over the surface and groundwater of the Colorado River,¹²⁵ provides another example of an international instrument which considers groundwater within the unitary whole of the hydrologic cycle. The Draft Treaty was developed; (1) to be used as a blueprint for treaties regulating international groundwater resources, (2) to facilitate cooperation, and (3) to achieve optimum utilization of the resource.¹²⁶

The preamble to the Draft Treaty provides that the "conjunctive use of surface and groundwater" resources is the foremost means of achieving rational and efficient water use while simultaneously safeguarding those resources for the future.¹²⁷ Significantly, comment three discusses the

121. *Id.*

122. U.N. ECONOMIC COMMISSION FOR EUROPE, CHARTER ON GROUND-WATER MANAGEMENT at 1-2, U.N. Doc. E/ECE/1197, ECE/ENVWA/12, U.N. Sales No. E.89.II.E.21 (1989).

123. *Id.* art. II ¶ 2.

124. Hayton & Utton, *supra* note 3, at 663 & 665.

125. *See id.* at 665. The Draft Treaty was the product of the United States-Mexican Transboundary Resource Study Group formed in 1977 to resolve transboundary water issues of the region. *Id.* The first study group met in Oaxtepec, Mexico and subsequent groups met in Puerto Vallarta and Ixtapa, Mexico. *Id.* The meeting leading to the framing of the Bellagio Draft was held in 1987 in Bellagio, Italy. *Id.* at 665-66.

126. *See* Hayton & Utton *supra* note 3, at 663 & 665. The Draft was presented at a special Panel Session of the Sixth Congress of the International Water Resources Association in Ottawa, Canada in May of 1988, for observations and suggestions. *Id.* at 665. Editing and revisions were made in early 1989 and the final draft was printed in 1989 in the Natural Resources Journal. *See id.*

127. *See id.* at 677. "Conjunctive use" is defined as "the integrated development and management of surface and groundwater as a total water supply." *Id.*

definition of "conjunctive use" and explains that the phrase is rooted in the hydrologic interrelationship and interdependence between surface and groundwater, which further emphasizes the reciprocal effect one has on the other.¹²⁸

In addition, at a 1988 Interregional Meeting on River and Lake Basin Development held in Addis Ababa, Ethiopia, government officials and international experts offered recommendations with respect to water resources management.¹²⁹ Notably, one recommendation advocated governments in the African continent to recognize that by accepting the drainage basin principle, as well as the hydrologic interrelationship between all sources of water, integrated and cooperative management of the region's water resources could best be achieved.¹³⁰ Moreover, the group advocated for the necessity of a "system approach" to water resource management, "given the interdependence and diversity of the components of the hydrological cycle — surface water, underground water, the water-atmosphere interface and the fresh water-marine interface."¹³¹

The particular importance of the Addis Ababa recommendations lies, in part, in the explicit use of language acknowledging the interrelationship of surface and groundwater. Importantly, the recommendations are an exceptional example that governments and policy makers, who many times have the most influence over water management policies, widely recognize and accept this correlation.¹³² This

at 678.

128. See Hayton & Utton, *supra* note 3, at 679. Moreover, the comment further explains that due to variations in water quality and quantity found in different water resources in many instances, "optimum utilization" may only be achieved by considering the hydrologic relationship of the resources as a unitary whole. *Id.* at 680.

129. UNITED NATIONS ECONOMIC COMM'N FOR AFRICA AND DEPARTMENT OF TECHNICAL CO-OPERATION FOR DEVELOPMENT, INTERREGIONAL MEETING ON RIVER AND LAKE BASIN DEVELOPMENT WITH EMPHASIS ON THE AFRICA REGION, (Oct. 10-16, 1988) (report of the meeting), *reprinted in*, Hayton & Utton, *supra* note 3, at 671-673 (report was adopted unanimously).

130. Hayton & Utton, *supra* note 3, at 671.

131. *Id.* The group also proposed that governments abide by recognized rules of international law applicable to water resources and that these rules apply in the interpretation of agreements as well as in the absence of an agreement. *Id.* at 672.

132. See McCaffrey, *supra* note 96, at 163 (noting the explicitness of the

recognition supports the premise (now a recognized principle of international law) that international water law applies equally and without distinction to both surface water and groundwater.

D. Summary

The inclusion of transboundary groundwater within the legal regime governing international water resources is a relatively recent concept in the development of international water law. It is following, albeit slowly, the acknowledgment by science that the two sources of water are indissociable and interdependent such that the deterioration of one will likely have serious consequences upon the other. The recognition of this nexus by planners and policy makers is especially crucial in light of the growing demands being placed on water resources globally.

Where transboundary water management and protection schemes are contemplated, an integrated approach must be undertaken.¹³³ This requires cooperative efforts and communication among co-riparians based upon the principles previously discussed. Specifically, states which share transboundary waters must cooperate along the lines of either the principle of reasonable and equitable utilization or of the community of interests, and always under the principles of prior notice and negotiation, and *sic utere tuo*.

In order to promote this integrated approach, decisions regarding the environment, particularly water resources, must be made with a scientific understanding of the possible consequences. Policy makers, legislatures, and even legal experts must become more aware of the relevance of science to planning and decision-making affecting transboundary natural resources. Towards that end, hydrogeologists, hydrologists, chemists, engineers, and other

recommendations which recognize the hydrologic cycle as a unitary whole).

133. Cf. BOWEN, *supra* note 7, at 344-56 (discussing the procedure of *conjunctive use*, which involves coordinating the management of surface and groundwater resources, and offering case examples of co-managed schemes).

appropriate scientists should be included in all aspects of preparation and project designs. More importantly, these scientists must also become involved in legislative efforts whenever environmental issues arise, both in the domestic as well as the international context.

Mankind is more aware today than ever before of the delicate balance found in nature, and of the ability of modern society to destroy the environment absent restraint and proper planning. Only through cooperation and an integrated approach towards transboundary resource management will states be able to manage their shared resources appropriately, effectively, and in such a way that the resources suffice for present needs and are preserved for future generations.

PART II

In the discussion below, groundwater issues in the Gabčíkovo-Nagymaros dispute are examined in the context of international water law. Section A begins with an overview of the current controversy, including a general description of the groundwater-related concerns involved. Section B then applies international water law to the dispute and considers the issue of whether international water law, *vis-a-vis* groundwater resources, was violated when Slovakia unilaterally diverted the Danube River and began operation of the Gabčíkovo Dam.

A. The Dispute Over the Gabčíkovo-Nagymaros Project

On May 13, 1989, the Hungarian Government suspended construction of a dam and system of locks at Nagymaros pending further study into the environmental impact of the project.¹³⁴ The construction scheme was part of the

134. See *Declaration of the Government of the Republic of Hungary on the Termination of the Treaty Concluded Between the People's Republic of Hungary and the Socialist Republic of Czechoslovakia on the Construction and Joint Operation of the Gabčíkovo-Nagymaros Barrage System*, § I, ¶ 9 (May 19, 1992) (on file with SUFFOLK TRANSNAT'L L. REV.) [hereinafter *1992 Declaration*] (providing brief chronology of events leading up to final abrogation of the 1977 Treaty).

Czechoslovak-Hungarian Agreement of 1977 ("1977 Treaty")¹³⁵ that called for bilateral cooperation in the development of a massive barrage system along the Danube River.¹³⁶ The suspension came in response to new evidence,¹³⁷ as well as to a wave of protests from environ-

135. Treaty Between the Hungarian People's Republic and the Czechoslovak Socialist Republic Concerning the Construction and Operation of the Gabčíkovo-Nagymaros System of Locks, Sept. 16, 1977, Czech.-Hung., 1109 U.N.T.S. 168 [hereinafter *1977 Treaty*]. The 1977 Treaty came into force on June 30, 1978, upon the exchange of instruments of ratification.

The Gabčíkovo-Nagymaros Treaty was undertaken by Czechoslovakia, a federation composed of the Czech and Slovak Republics. *Id.* Until the breakup of the federation in January of 1993, the federal government supported the continuance of the project under heavy pressure from the Slovak Republic. *See Dispute Over Dam Threatens to Derail Czech Government*, SAN. FRAN. CHRON., Oct. 28, 1992, at A10 (noting that Czechoslovak Government threatened to resign in frustration over disagreement between Slovak and Czech ministers relating to Gabčíkovo dispute with Hungary). Following political separation, Slovakia assumed all responsibility for the 1977 Treaty and for construction of the barrage system. *Id.* For the sake of simplicity, the name Slovakia is used in this article to represent both the pre-January 1992 Czechoslovak and the post-January 1993 Slovak governments.

136. *See 1977 Treaty*, *supra* note 135, ch. I, art. 1. The agreement called for dams and navigation locks at Hrusov/Dunakiliti and Nagymaros, Hungary, and, at Gabčíkovo, Slovakia; hydroelectric power plants, at Nagymaros and Gabčíkovo; and the deepening of the Danube River in specified locations. *Id.* The dam at Dunakiliti was to rout 95% of the Danube River into a seventeen mile power canal — flowing parallel to the old Danube River channel located five miles within Czechoslovakia's boarder — and towards the Gabčíkovo Dam. *Id.* A second canal was to lead the water from the Gabčíkovo dam back to the old Danube River channel. *Id.* As the Gabčíkovo power plant was intended to operate only at peak hours, great fluctuations were expected in water flow and level. *Id.* Hence, the Nagymaros dam was planned 100 kilometers downstream from Gabčíkovo to compensate for the fluctuations and to return the Danube to its normal level and flow. *1977 Treaty*, *supra* note 135, ch. I, art. 1. The construction costs of the project, as well as the energy produced from the power plants, were to be shared equally. *Id.*

The principal reasons for developing the barrage system included: generation of low cost electricity, improved navigation of the Danube, and enhanced flood control. *Id.* For helpful commentary on these points, *see* Paul R. Williams, *International Environmental Dispute Resolution: The Dispute Between Slovakia and Hungary Concerning Construction of the Gabčíkovo and Nagymaros Dams*, 19 COLUM. J. ENVTL. L. 1, 7-8 (1994).

137. *See 1992 Declaration*, *supra* note 134, at § I, ¶¶ 9, 12-13 (explaining that environmental concerns were primary reasons for suspension of Nagymaros and Dunakiliti portions of project). *But see* Miklos Kozak, *Gabčíkovo as the Trojan Horse For a Change of Power in Hungary*, 4 EUROPA VINCET 28, 29-32 (1993) (asserting that the renunciation of the 1977 Treaty and the subsequent inability to achieve acceptable compromise is not due to environmental concerns but rather to internal Hungarian politics and individual political ambi-

mentalists,¹³⁸ suggesting that the project was likely to result in grave environmental damage, both within and outside the country.¹³⁹

Throughout subsequent discussions between Slovakia and Hungary, and over the objections of the Hungarians,¹⁴⁰ Slovakia continued the construction of its portion of the barrage system at Gabčíkovo.¹⁴¹ The Slovaks also devel-

tions). Kozak declared that "[t]he campaign against the hydro-electric power-plant in our massmedia [sic] is the biggest falsification of history." *Id.* at 32.

138. *East Europeans Protest Danube Dam Project*, THE CHRISTIAN SCI. MONITOR, Feb. 5, 1990, at 4. On February 3, 1990, an estimated 100,000 Czechoslovaks, Hungarians, and Austrians formed a human chain along the Danube in protest over the construction of the Gabčíkovo Dam project. *Id.* The chain stretched over 100 miles from Hainburg, Austria, across to Bratislava, Slovakia, and to Komarom in Hungary. *Id.*; see also Denise Hamilton, *Hungarian Target Danube Dam Project*, L.A. TIMES, Aug. 13, 1989, at 1 (describing efforts of Janos Vargha, a Hungarian environmentalist and one of Hungary's leading opponents of Gabčíkovo-Nagymaros project); Letter from World Wildlife Fund Austria to "Environmentalists and Conservationists" (Sept. 10, 1991) (on file with author) (describing potential economic and social repercussions, as well as environmental consequences, of the project, and promoting the "Stop Gabčíkovo" campaign).

139. See Karoly Perczel & George Libik, *Environmental Effects of the Dam System on the Danube at Bös-Nagymaros*, 18 AMBIO 248-49 (forecasting potentially serious environmental consequences of project); Deak Interview, *supra* note 85 (explaining that in late 1980s, public concern over Gabčíkovo-Nagymaros project increased in Hungary as potential environmental consequences became public knowledge); see also Pál Liebe and György Tóth, *Hydrological and Hydrogeological Problems of the "Szigetköz" in Relation to the Bös/Gabčíkovo-Nagymaros Hydropower Scheme*, Paper presented at the Hungarian Embassy in Washington, D.C. 11-12 (Oct. 21, 1993) (transcript on file at SUFFOLK TRANSNAT'L L. REV.) (giving results of recent study into environmental consequences of the diversion of the Danube River on the region's surface and groundwater, and forecasting further deterioration in the quality of the waters).

140. See Peter Maass, *Hungary Demands Halt in Slovakia's Diversion of Danube*, WASH. POST, May 22, 1992, at A32 (relating Hungary's demands of Slovakia to suspend construction of project pending amicable resolution); see also 1992 Declaration, *supra* note 134, § I, ¶¶ 19-21, 24 (asserting that on a number of occasions, Hungary requested Czechoslovakia and Slovakia to suspend construction until achievement of acceptable agreement). Citing to the implacable position of the Slovak side as well as to grave environmental consequences, Hungary eventually terminated the Treaty in May of 1992. The Declaration of Termination states that, "Hungary cannot accept . . . that irreversible damage afflicts the ecological and environmental resources of the region, first of all the presently available and potential drinking water reserves of millions of people, [and] that degradation and, in certain cases, extinction threaten the vegetation and fauna of the region" *Id.* at 1.

141. Judith Ingram, *Nations at Odds Over Huge Dam Project — Environmen-*

oped "Option-C," a variation of the original plans that called for the unilateral diversion of the Danube into a side canal,¹⁴² at a point wholly within Slovak territory.¹⁴³ On October 25, 1992, soon after the completion of the dam at Gabčíkovo, Slovakia diverted the Danube River¹⁴⁴ despite Hungary's requests for a temporary delay pending a compromise.¹⁴⁵

As a result of the diversion, the overall flow of water

tal Concerns Cause Hungary to Stall Venture with Czechoslovakia, SAN. FRAN. CHRON., Jan. 3, 1991, at A18 (noting that Slovakia "stubbornly continues construction"); see *Danube Locked in Hydroelectric Power Failure*, PLAIN DEALER, Mar. 7, 1992, at 13A (noting that construction is proceeding at Cunovo).

142. *Standpoint of the Czecho-Slovak Side and Answers to Questions* 17 (Apr. 1992) (on file with author) [hereinafter *Standpoint of the Czecho-Slovak Side*]. According to Slovakia, the variation was to make up for the absence of the Hungarian portion of the plan. See *id.* (declaring that Option-C was developed in order to mitigate economic losses sustained as result of Hungary's refusal to continue with original plan); cf. Gabor Szabo, *Conflict on the Danube: Only Losses*, 11 HUNGARIAN ECON. REV., 57-58 (1992) (asserting that the optimal and most economical operation of the Slovak power plant at Gabčíkovo was unlikely without the Hungarian dams at Nagymaros and Dunakiliti).

143. Miroslav B. Liska, *Gabčíkovo-Nagymaros: A Review of Its Significance and Impacts*, 45 INT'L WATER POWER AND DAM CONSTR. 36 (1993). The canal diverts the river's water at Cunovo, Slovakia, just north of Dunakiliti, Hungary, effectively diverting the flow of the river before it reaches Hungarian territory. *Id.* at 36 fig. 2. The water then flows through the original power canal towards the Gabčíkovo dam, and is then returned to the Danube after Gabčíkovo via a canal. *Id.*

144. See *On the Ecological-Environmental Effects of the Gabčíkovo-Nagymaros Barrage System* 8 (October 1993) (Hungarian Ministry of Environment and Regional Policy) [hereinafter *On the Ecological-Environmental Effects*]; see also Peter Maass, *Where the Danube Runs Dry - A Slovak Dam Empties a Stretch of River*, WASH. POST, Nov. 30, 1992, at A1 (stating that diversion of Danube River actually began on October 24, 1992, and describing effects of diversion).

145. See Maass, *supra* note 140, at A32 (describing dispute and Hungary's demands of Slovakia to suspend construction); see also *1992 Declaration*, *supra* note 134, at § I, ¶¶ 19-21, 24 (describing Hungary's requests for delay in construction). Slovakia contended that its refusal to delay construction of the dam and diversion of the river was economically justified as the country's major investment into the project, coupled with Hungary's refusal to comply with the terms of the 1977 Treaty, was financially burdensome for Slovakia. See *Standpoint of the Czecho-Slovak Side*, *supra* note 142, at 15-16 (explaining reasons for Slovakia's refusal to halt project); see also Carrol J. Williams, *Dam Unleashes Flood of Hostility*, L.A. TIMES, Dec. 1, 1992, at H3 (quoting head of Slovak water directorate saying that, to date, project costs top \$1 billion). Moreover, Slovakia argues that the need for clean energy and flood protection outweighs the unsubstantiated risks to the environment. *Standpoint of the Czecho-Slovak Side*, *supra* note 142, at 15-16.

into the original channel, at the point of diversion, dropped as much as eighty percent¹⁴⁶ causing the water level in the river section between Rajka and Dunaremete in Hungary to drop by two to four meters.¹⁴⁷ Consequently, much of the water in side-branches of the Danube River in the Szigetköz region,¹⁴⁸ adjacent to the section of river side-tracked by the diversion, also disappeared¹⁴⁹ destroying both aquatic life and area flora.¹⁵⁰ It also affected the wa-

146. See Liebe and Tóth, *supra* note 139, at 5, 10 (asserting that water flow into main channel of Danube dropped from an average of 2064 cubic meters per second to approximately 200-350 cubic meters per second). By September of 1994, only twenty cubic meters per second was flowing into the original channel. See *Slovakia's Water Diversion into Szigetköz Danube Bed Delayed*, BBC, Sept. 6, 1994, available in LEXIS, Nexis Library, Wires File.

147. See Liebe and Tóth, *supra* note 139, at 10 (stating that diversion of river caused water level of Danube River, in section bypassed by the diversion, to drop by two meters, as compared to average water level, and by three meters, as compared to growing season water level); COMMISSION OF EUROPEAN COMMUNITIES, REPUBLIC OF HUNGARY, WORKING GROUP OF MONITORING AND WATER MANAGEMENT EXPERTS FOR THE GABCIKOVO SYSTEM OF LOCKS, DATA REPORT: ASSESSMENT OF IMPACTS OF GABCIKOVO PROJECT AND RECOMMENDATIONS FOR STRENGTHENING OF MONITORING SYSTEM 17 (Nov. 2, 1993) [hereinafter DATA REPORT 1] (noting that water levels in the old Danube at Rajka and Dunaremete fell by two to four meters to a level two meters below the lowest levels ever recorded); see also Maass, *supra* note 144, at A1 (describing cases of falling water table and drying up of wells along the portion of Danube River by-passed by the diversion).

148. The Szigetköz region is the area between the main channel of the Danube River and the Mosoni-Danube, a natural side-arm of the Danube, composed of numerous smaller side-arm channels and islands. The region is also adjacent to the section of the Danube River cut off from the natural flow of water. Liebe and Tóth, *supra* note 139, at 10.

149. See *On the Ecological-Environmental Effects*, *supra* note 144, at 8 (stating that around 70 percent of the side branches have dried up as a result of the diversion of river).

150. See *id.* (noting that 91% of fish species in Szigetköz region are now threatened with extinction due to diversion of the Danube); Juan O. Tamayo, *Hungary, Slovakia in Feud Over Danube*, MIAMI HERALD, Nov. 13, 1992, at 1A (noting that Slovak environmentalists reported a large fish kill soon after the diversion of the Danube River); see also Williams, *supra* note 136, at 16-17 (describing forecasts that 80-90% of the 5000 animal species in the region will likely be destroyed); COMMISSION OF EUROPEAN COMMUNITIES, REPUBLIC OF HUNGARY, WORKING GROUP OF MONITORING AND WATER MANAGEMENT EXPERTS FOR THE GABCIKOVO SYSTEM OF LOCKS, DATA REPORT: REPORT ON TEMPORARY WATER MANAGEMENT REGIME 1, 32-33 (Dec. 1, 1993) [hereinafter DATA REPORT 2] (noting that in DATA REPORT 1, no significant trends could be documented, but that if the present situation continues, significant changes to the flora and fauna will likely occur in the immediate areas of the river).

ter table in the Szigetköz region causing it to drop well below normal levels¹⁵¹ and dry up many village water wells.¹⁵² In addition, the drop in water volume induced settling of particles,¹⁵³ typically suspended in the water flow, thus threatening the filtering capacity of the river bed and increasing the likelihood of aquifer contamination.¹⁵⁴

Significantly, Hungarian hydrogeological studies showed that the water table in the middle Szigetköz area, along the depleted portion of the Danube River, dropped significantly by as much as one to two meters.¹⁵⁵ Quite ominously, environmentalists and Hungarian scientists projected further

151. See DATA REPORT 1, *supra* note 147, at 28-37 (giving statistical data showing that water table levels near the reservoir, and throughout the Slovak-Danube region, have increased or stayed the same while those further downstream on the Hungarian side, including in the middle Szigetköz region, have fallen).

152. See Maass, *supra* note 144, at A1 (recounting stories of the local population, on both Slovak and Hungarian sides of border, whose wells have dried up); Williams, *supra* note 145, at H3 (reiterating claims of environmentalists that the diversion of Danube dried up wells on the Hungarian side of the river).

153. See DATA REPORT 1, *supra* note 147, at 25 (noting that in certain portions of the old Danube, downstream from Cunovo, fresh sedimentation is one to two meters thick). It is noteworthy that upstream of the reservoir, all of the bed load and 60 percent of the suspended load of the river has settled onto the reservoir and river bottom. *Id.*

154. Deak Interview, *supra* note 85. Danube River water is of a particularly high quality due to the naturally filtering bio-active pebble-bed lining the river floor, particularly in the Szigetköz region. See Williams, *supra* note 136, at 14. As water flow decreases and settling of particles increase, the filtration system will become congested. *Id.* at 14-15. This, in turn, will allow industrial pollutants, heavy metals, toxins, and other contaminants, normally suspended in the water by the volume and flow of the river, to permeate into the aquifer and pollute fresh water supplies. Deak Interview, *supra* note 85; Williams, *supra* note 136, at 14-15. Preliminary groundwater quality studies suggests that groundwater pollution in the region is already increasing faster than had been expected. Debora MacKenzie, *Dam Pollution Data Leaked From Slovakia*, NEW SCIENTIST, May 8, 1993, at 7 (reporting that portions of a study commissioned by the Slovak ministry which operates the Gabčíkovo Dam, shows that downstream from the diversionary barrage at Cunovo, water contained 1/4 of the normal levels of oxygen and above normal levels of ammonia and hydrogen sulfide).

155. Liebe and Tóth, *supra* note 139, at 11 (noting that near Danube River, water table dropped by one to two meters while at a distance from the river, the drop was approximately one meter). Hungarian studies also show that in the area directly adjacent to the new reservoir, the water table actually rose approximately one meter due to seepage from the reservoir. *Id.*

consequences¹⁵⁶ including the continued degeneration of the groundwater aquifer in the Szigetköz region.¹⁵⁷ These measurements and projections of future damage, however, were strongly disputed by the Slovaks,¹⁵⁸ and even by

156. See, e.g., Juliet Serenyi, *Danube Project Sours*, CHRISTIAN SCI. MONITOR, Dec. 9, 1992, at 19 (charging that completion of dam would destroy natural filtration of Danube River bed and thus also groundwater reservoir); Deak Interview, *supra* note 85 (contending that the region's groundwater likely to deteriorate significantly over next few years as result of river's diversion); Rudolph Chelminski, *The Not So Blue Danube: A Storied Link Between Europe's Old and New*, SMITHSONIAN, July 1990, at 32 (noting risk posed by project to distinct ecosystem sustaining approximately 5,000 species of wildlife); see also *On the Ecological-Environmental Effects*, *supra* note 144, at 4-6 (describing harmful effects expected as a result of the diversion of the Danube River and the operation of the Gabčíkovo power plant). But see Liska, *supra* note 143, at 36 (contending that both diversion of river and operation of Gabčíkovo dam are environmentally friendly projects which would preserve the environment).

157. Deak Interview, *supra* note 85 (contending that the groundwater table may continue to drop while contamination from wastes and heavy metals increase as a result of the diversion of the Danube River); DATA REPORT 2, *supra* note 150, at 31 (forecasting that if no remedial measures are taken soon, sedimentation will continue in the main branches of the river on the Hungarian side and will clog up the river bed with fine material and mud which will prevent water infiltration to the aquifer). The groundwater aquifer in the Szigetköz region extends (underneath the surface) across the Hungarian-Slovak border and is hydrologically linked to the Danube River. See Liebe and Tóth, *supra* note 139, at 1-12 (describing interrelationship between Danube River and region's groundwater and the effect river has on groundwater on both sides of border). The Danube is in fact the primary source of water for the aquifer. Deak Interview, *supra* note 85; DATA REPORT 1, *supra* note 147, at 28 (describing the size of the aquifer as a function of the permeability of the river channels and high infiltration of water from the Danube River). As a result of the diversion of the Danube River, the amount of water infiltrating into the groundwater aquifer is expected to decline for two reasons: 1) the plastic lining of the diversion channel (used to improve water flow) does not permit water to filter into the ground; and 2) silting of the main channel's river bed will likely increase, as a result of reduced flow of water, thus reducing its porous capacity. Deak Interview, *supra* note 85. Consequently, the region's groundwater resources are expected to be detrimentally affected. *Id.*

The significance of the groundwater aquifer in the Szigetköz region is manifest in the fact that it is the largest (though still not used to full potential) reserve of fresh water in Europe. See Tamayo, *supra* note 150, at 1A. Hungary, for example, relies on the aquifer for nearly fifty percent of its fresh water. *Id.* (stating that the large aquifer provides potable water to five million people in Hungary and Slovakia). As the aquifer is fed primarily by waters percolating from the Danube, any deleterious effect in the quality and quantity of water in the Danube is likely to have a serious effect upon Hungarian agriculture, economy, and community. Deak Interview, *supra* note 85.

158. See Miroslav B. Liska, *Gabčíkovo Project - Catastrophic Forecasts Fall-*

some Hungarians.¹⁵⁹

The construction of the dam and diversion of the Danube River has sparked a heated controversy between Slovakia and Hungary. Among other arguments, the Hungarian Government claims that Slovakia's unilateral diversion and regulation of the Danube River, an international waterway, constitutes an infringement of Hungarian territorial sovereignty and integrity¹⁶⁰ and violates international law.¹⁶¹ Furthermore, Hungary asserts that the action violates the principles of customary international law governing the utilization of shared international resources which includes groundwater.¹⁶² In rebuttal, Slovakia contends that the completion of the Gabčíkovo Dam and the diversion of the Danube were legitimately carried out in response to Hungary's suspension of construction at Nagymaros and eventual renunciation of the 1977 Treaty.¹⁶³ In addition, they contest the scientific

ing into Pieces, 3 EUROPA VINCET 15-18 (1993) (citing Slovak government studies which suggest that projections of environmental catastrophe were unwarranted and unsubstantiated, and that project is actually beneficial to environment). Slovakia also insists that returning the Danube River to its pre-October 25, 1992 situation is not environmentally desirable. *Id.* at 17. Upstream projects of the last twenty years resulted in significant modification of the river bed and flow of solid material. As a result, the Slovaks contend that the river's pre-November 1992 or "natural" condition was in fact eroding the river bed and lowering the water level in the river as well as in the adjacent aquifers. *Id.*

159. See Kozak, *supra* note 137, at 32 (contending that environmental risks were greatly exaggerated by government and any potential harm could be adequately mitigated by technological means); see also *Hungarian Experts Urge Completion of Controversial Danube Dam*, BBC, Sept. 26, 1994, available in LEXIS, Nexis Library, Wires File (reporting that the Water Management Science Committee of the Hungarian Academy of Sciences is urging the completion of water barrage system).

160. 1992 Declaration, *supra* note 134, § III, ¶ 5(a) (asserting that because the Danube River is an international river, neither party can exercise unilateral control over the river such that it affects the flow or course of the river).

161. *Id.* § III, ¶ 5(e) (contending that Slovakia's action "seriously violated . . . norms of international law," and, more specifically, the rule which prohibits states from effecting appreciable harm to the territory of other states).

162. *Id.* III, ¶ 5(d) (contending that because the diversion of the river deprives Hungary of its fair share of the resources of the Danube, Slovakia's action transgressed "the rules and principles of customary international law" governing the use of transboundary resources).

163. See MIROSLAV B. LISKA, THE GABCIKOVO-NAGYMAROS PROJECT - ITS REAL SIGNIFICANCE AND IMPACTS 1, 6 (1993) (official pamphlet of the Slovak Ministry of Agriculture) (declaring that Slovakia's only reasonable response to

evidence suggesting that their actions caused, and will continue to cause, deleterious effects upon the region's groundwater and the overall environment.¹⁶⁴ Following futile negotiations, the two governments referred the dispute to the International Court of Justice for resolution.¹⁶⁵

B. International Water Law and the Gabčíkovo-Nagymaros Project

The following issues and discussion are based upon international water law as previously discussed. It is noteworthy that these questions constitute only a fraction of the issues involved in the case now before the International Court of Justice.¹⁶⁶ Thus, the resolution of these issues does not alone suffice to determine whether Slovakia's actions violate

the suspension of construction by Hungary was to fulfill the objectives of the original agreement as best as was possible and to mitigate damages); *Standpoint of the Czecho-Slovak Side*, *supra* note 142, at 9 (declaring that actions of Slovakia "are defensive in character and have to be considered as an effort to diminish the damages accruing from the delay of operation . . .").

164. See Liska, *supra* note 158, at 16 (citing Slovak Government studies that contradict estimates made by Hungary). Slavic studies done subsequent to the diversion of the Danube have shown a three to four meter rise in the groundwater level "in the decisive section" of the river, and, further downstream at Dunajská Streda, a rise of fifty centimeters. *Id.*; see also Liska, *supra* note 163, at 8-9 (listing positive effects of project on environment of the region).

165. See *Hungary, Slovakia to Let Court Decide Dam Dispute*, CHICAGO TRIB., Apr. 8, 1993, at 4 (stating that Hungary and Slovakia agreed on April 7, 1993, to have the matter settled by the World Court); see also *Hungary and Slovakia Submit Legal Documents on Gabčíkovo to the Hague*, BBC, Sept. 4, 1994, available in LEXIS, Nexis Library, Wires File (reporting that Hungary and Slovakia officially submitted their dispute to the World Court on May 2, 1994).

166. See Letter from David Hunter, Center for International Environmental Law, to the Government of Slovakia (Oct. 29, 1992) (on file with author) (considering whether Slovakia's unilateral diversion of the river violates the principle of state responsibility, whether it illegally changed the border established by treaty, and whether it was a justified act under international law in response to Hungary's suspension of construction); *Standpoint of the Czecho-Slovak Side*, *supra* note 142, at 4-23 (addressing numerous questions, including whether Hungary's suspension of construction violated the 1977 Treaty, whether Hungary's actions was justified under international law, and whether the diversion of the river violates prior border agreements); see also Williams, *supra* note 136 (assessing numerous legal issues involved in the dispute, throughout the article, and weighing the persuasiveness of various argument that might be offered by the litigants).

international law. The objective of the present analysis is to outline the basic questions relevant to the analysis in the controversy, *vis-a-vis* groundwater resources, and to provide legal arguments such that given all the evidence, a tribunal may reach a justiciable conclusion. More importantly, the aim is to provide a framework upon which similar issues of shared resources may be considered.

1. Whether Slovakia's Actions Were Contrary to the Rights of and Caused Appreciable Harm to Hungary, Such That Slovakia Violated International Water Law and the Principle of Sic Utere Tuo

To support the contention that Slovakia violated the principle of *sic utere tuo*, Hungary must first establish that Slovakia's action was contrary to the rights of Hungary, causing some measure of injury. Already before October 25, 1992, when Slovakia unilaterally diverted the Danube River and began operating the Gabčíkovo Dam, the evidence indicated that deleterious environmental consequences would ensue,¹⁶⁷ most notably to the region's groundwater.¹⁶⁸ More importantly, studies conducted subsequent to the diversion of the Danube revealed that Slovakia's actions actually did cause damage to the territory of Hungary.¹⁶⁹

167. See Perczel & Libik, *supra* note 139, at 248 (forecasting serious environmental consequences, including deterioration of region's water quality and contamination of groundwater in 1989); 1992 Declaration, *supra* note 134, at 15-22 (asserting that substantial harm will ensue, including the deterioration of surface and groundwater and the destruction of the region's ecology); see also Deak Interview, *supra* note 85 (noting that in late 1980s, public concern over Gabčíkovo-Nagymaros project increased in Hungary as potential environmental consequences became public knowledge); cf. Letter from Leonard Sklar, Research Director, International Rivers Network, to Jaromir Sibl c/o David Hunter, Center for International Environmental Law (Nov. 8, 1991) (on file with author) (discussing 1988 International Conference on Sustainable Water Development Solutions' vote to place the Gabčíkovo-Nagymaros project into its category of the "Terrible Ten: The World's Worst Dam Projects").

168. See 1992 Declaration, *supra* note 134, at 15, 17-19 (pointing out that the results of three environmental studies were presented to Slovakia, all of which warned of serious consequences to the groundwater of the region).

169. See *supra* notes 131-41 and accompanying text (describing consequences of Slovakia's actions, including substantial drop of water volume and flow in

Although Slovakia disputes the validity of the studies¹⁷⁰ and considers Hungary's conclusions unfounded and exaggerated,¹⁷¹ the evidence may be sufficient for the court to determine that harm did occur as a direct result of the diversion of the river and the operation of the dam.

Establishing that harm occurred, though, is only part of the requirement for showing a violation of the principle. Hungary must further show that the harm caused by Slovakia is appreciable.¹⁷² Hungary contends that Slovakia's actions caused significant injury to its environment,¹⁷³ jeopardized the agricultural productivity of the region,¹⁷⁴ and continues to seriously threaten public health because of deteriorating water quality.¹⁷⁵ If Hungary substantiates its claims that contamination and depletion of the groundwater reservoir directly impacted the environment, the economy, and the population, the court will likely find that Hungary suffered appreciable harm as a result of Slovakia's conduct.¹⁷⁶ Whether that degree of evidentiary material is sufficient to show appreciable harm, however, must be determined by the court.

the bypassed section of the Danube, destruction of aquatic life and area flora, and a drop in the region's water table).

170. See *Standpoint of the Czecho-Slovak Side*, *supra* note 142, at 13-15 (contesting Hungarian assertions that the project will harm the environment).

171. See Liska, *supra* note 158, at 15-18 (citing Slovak government studies contending that "catastrophic forecasts" were unsubstantiated and have not been fulfilled); Liska, *supra* note 143, at 36 (contending that Slovakia's projects are environmentally friendly and actually work to preserve the environment).

172. See *ILC Draft Articles*, *supra* note 26, art. Seven (asserting that states "shall" not cause "appreciable harm" to the another states); see also *supra* notes 87-89. To establish an injury as "appreciable," it must have a significant and consequential effect upon public health, economic productivity, or the environment of another state. See *supra* note 88 and accompanying text.

173. See *On the Ecological-Environmental Effects*, *supra* note 144, at 8 (asserting that ninety-one percent of fish species in Szigetköz region are now threatened with extinction due to diversion of the Danube); Tamayo, *supra* note 150, at A1 (noting that Slovak environmentalists reported a large fish kill soon after diversion of the Danube River).

174. See Serenyi, *supra* note 156, at 19 (noting that the agriculture of the region is at risk from deteriorating water quality and quantity).

175. See Liebe & Tóth, *supra* note 139, at 11-12 (presenting their study which found that Slovakia's action have affected groundwater in the region).

176. See *supra* note 34 and accompanying text.

In addition, Hungarian hydrogeological studies are significant in that they suggest further consequences to the environment are expected, albeit some may not manifest for years.¹⁷⁷ Although the accuracy of these forecasts are disputed by Slovakia,¹⁷⁸ they should not be precluded from consideration. To ignore the possibility of imminent and serious environmental harm, because of uncertainty, would be contrary to the principle of *sic utere tuo* as the opportunity to prevent the harm would be foregone. Consequently, a precautionary approach should be taken when considering potential future harm.¹⁷⁹

2. *Whether Slovakia's Actions Infringed Upon Hungary's Rights to and Interests in the Utilization of the Region's Transboundary Groundwater Resources in Violation of International Water Law*

Every state has certain rights and interests in the utilization and exploitation of its natural resources.¹⁸⁰ Those rights and interests, however, are limited to the extent that they do not infringe upon the interests of other states.¹⁸¹

177. See Liebe and Tóth, *supra* note 139, at 11 (contending that "[i]n this summer (1994) the deterioration of the quality of surface water is expectable [sic] and in the coming years they [sic] will eventually deteriorate the quality of the subsurface waters too"); see also Deak Interview, *supra* note 85 (predicting the gradual and serious deterioration of groundwater quality in the region).

178. See *supra* notes 156, 158, 163-64 and accompanying text.

179. See Daniel Bodansky, *Scientific Uncertainty and the Precautionary Principle*, 33 ENVIRONMENT NO. 7 4, 4-5 (1991) (advocating for the application of a precautionary approach to environmental issues in order to prevent environmental harm). The precautionary principle provides that where a man-made substance or activity poses a threat to the environment, the lack of scientific certainty shall not be used as a reason for deferring precautionary measures aimed at preventing environmental harm. *Id.*; see also *Rio Declaration*, *supra* note 25, at princ. Fifteen (stating that "[w]here there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation").

180. See *Rio Declaration*, *supra* note 25, at Princ. Two (providing that states have the unlimited sovereign right to exploit resources within their own territory insofar as they do not infringe upon the rights of other states); see also *Stockholm Declaration*, *supra* note 25, at Princ. Twenty-One (stating a nearly identical provision as Principle Two of the Rio Declaration).

181. See *Rio Declaration*, *supra* note 25, at Princ. Two; *Stockholm Declara-*

Moreover, where states share transboundary resources, they necessarily must cooperate in order to prevent infringement upon the rights of one another.¹⁸² Thus, the principles of equitable and reasonable utilization and the community of interests provide frameworks for cooperation and mutual benefit.

Where states sharing a common transboundary resource embark on projects to exploit that resource, they are obliged to cooperate to the extent that they consider the rights of other states.¹⁸³ Thus, in pursuing its river development scheme, Slovakia was duty-bound to consider Hungary's interests in the water resource of the Danube River. Moreover, because of the interdependency and interconnection of the river to the region's groundwater, Slovakia was also obligated to appraise Hungary's interests in the groundwater of the area.

Whether Slovakia violated these responsibilities is contingent upon ascertaining the interests Hungary had in the transboundary water resources of the region against those of Slovakia. Under the principle of equitable and reasonable utilization, that determination is based on the evaluation of relative geographical, social, economic, and other factors.¹⁸⁴ Under the principle of community of interests, the determination would be based upon maximum efficiency and greatest beneficial use among the sharing states.¹⁸⁵

tion, *supra* note 25, at Princ. Twenty-One.

182. Cf. *supra* note 44 and accompanying text (discussing a balancing of the competing interests of states sharing a common resource).

183. See *supra* notes 43-44, 56-64 and accompanying text.

184. See *supra* notes 43-47 and accompanying text (describing the factors to consider). In the instant case, Slovakia certainly should have appraised the following factors: 1) the physical extent of the Danube River and interconnected groundwater aquifers lying within the territory of Hungary; 2) the relationship and dependency of the region's environment upon the river and aquifers and the impact the scheme would have on the flora and fauna and ecology of the region; 3) Hungary's reliance on the water resources for agricultural needs and potable water supplies; 4) the means for conserving and protecting water quality and quantity; and 5) possible alternatives to the planned project. *Id.*

185. See *supra* note 49 and accompanying text (noting that in order to maximize efficiency and benefit, the country which would gain the most from the use of a water resource, such as a water-poor nation, would likely have superior right of use over that transboundary water resource). Noteworthy is the fact

Consequently, the benefits gained by Slovakia in diverting the Danube and operating the Gabčíkovo Dam, as well as those gained by Hungary, must be weighed by the court against the determinative factors.

3. Whether Slovakia Violated the Principle of Good Faith Negotiations Under International Water Law, When Hungary Contested Slovakia's Environmental Impact Findings and When Slovakia Refused to Suspend Its Planned Project

Under the principle of good faith negotiations, states are obligated to enter deliberations when a dispute results from conflicting views as to the effects of a planned project or activity.¹⁸⁶ Thus, when Slovakia and Hungary produced contradictory analyses of the potential consequences resulting from the diversion of the Danube River and the operation of the Gabčíkovo Dam, both were under a duty to hold meaningful and good faith negotiations in order to verify the likely consequences of the project, and to attempt to resolve their differences. Representatives of Slovakia and Hungary met on a number of occasions, prior to October 25, 1992, to discuss the possible environmental effects of Slovakia's planned project. No understanding, however, was ever achieved.¹⁸⁷

Whether these discussions constituted a "good faith" attempt at reconciliation, though, also rests on the manner in which the parties participated in the deliberations. Negotiations must be conducted meaningfully and with a sincere

that Hungary relies upon the region's groundwater for nearly fifty percent of its potable water source. See Tamayo, *supra* note 150, at 1A (noting also that the aquifer provides potable water to five million people in both Hungary and Slovakia). Moreover, ninety-five percent of Hungary's surface water originates outside the country. Gleick, *supra* note 3, at 103, tbl 4.

186. See *supra* notes 60-64 and accompanying text.

187. See 1992 Declaration, *supra* note 134, § I, ¶ 11 (discussing the results of a number of conferences of experts and official meetings where both sides agreed on considering the project as a serious intervention on the environment but disagreed as to the appropriate method for preventing the environmental harm).

intent of reaching an amicable compromise.¹⁸⁸ This also means that both parties must be receptive to the suggestions and alternatives proposed by the other side in the discussions. Any action by either party which anticipates the outcome of the mediation, undermines the mutuality of the compromise and contradicts the obligation of good faith. Thus, inflexibility on a position may constitute a violation of the principle.¹⁸⁹

In their discussions, both sides contend that they alone made a good faith effort towards resolving the dispute, but that the other party was recalcitrant in its position and not sincerely interested in a compromise.¹⁹⁰ Consequently, whether Slovakia violated the principle of good faith negotiations, is contingent on the court's determination of these facts.

The principle of good faith negotiations further requires that the state which plans the potentially harmful activity, refrain from proceeding with its scheme until such time as a compromise is reached, or until a reasonable time has passed.¹⁹¹ Hungary contends that it requested Slovakia, on numerous occasions, to refrain from proceeding with construction of the project until an acceptable agreement was worked out.¹⁹² In response, Slovakia contends that it was justified in refusing to suspend the construction not only because of the heavy financial investments involved, but also because Hungary was not negotiating in good faith.¹⁹³

188. See *supra* notes 61-62 and accompanying text.

189. See *supra* notes 61-62 and accompanying text.

190. See *Standpoint of the Czecho-Slovak Side*, *supra* note 142, at 5-7 (contending that Hungary "was not interested in any positive action" and that their conduct was merely a "play for time"); see also 1992 Declaration *supra* note 134, § I, ¶ 25 (asserting that Hungary attempted to achieve a "mutual agreement . . . but met a permanent and consequent refusal on the Czech and Slovak side at every occasion").

191. See Hayton, *supra* note 26, art. Seventeen (3) (stating that the notifying state, if requested, must suspend its planned project for up to six months); see also *supra* notes 63-64, and accompanying text.

192. See 1992 Declaration, *supra* note 134, at 9, 11-13 (describing numerous times at which Hungary requested suspension of the construction).

193. See *Standpoint of the Czecho-Slovak Side*, *supra* note 142, at 15-16; see also *supra* note 163, and accompanying text.

In this instance, it is plausible that the court may find that Slovakia violated the principle of good faith negotiations when Slovakia refused to suspend construction, even temporarily. Nonetheless, the principle of negotiating in good faith requires that both parties work towards a mutually agreed-upon compromise. Thus, that determination may be attenuated if Slovakia's contentions that Hungary failed to negotiate in good faith are also sustained.

C. Conclusion

International law as it pertains to shared natural resources is being put to the test in the present dispute between Hungary and Slovakia. Both countries have claims upon the transboundary water resources of the region and both contend that the other violated their rightful use of those resources. Notwithstanding the lack of precedent, the dispute offers a prime opportunity for the application of international water law to questions of the use and ownership of transboundary groundwater resources. It also presents an opportunity for the development of international water law and for the application of an integrated approach to the management and protection of shared water resources. Such an approach requires cooperation and communication among co-riparian states and is essential for appropriate and effective administration of these finite resources. Consequently, the question remaining is whether international water law will meet the challenge of scientific knowledge and societal needs, or whether it will continue to lag behind the times.

D. Postscript

Since the submission of the Hungarian-Slovak dispute to the World Court in May 1994, little has occurred that might significantly affect the outcome of the case. Despite a series of talks aimed at improving relations and possibly reaching some accord on the issue,¹⁹⁴ there has been little

194. See *Slovakia, Hungary Start Talks on Danube Dispute*, Reuters, Sept. 6,

in the way of resolution over the dispute, and representatives of both side have expressed reservation over the likelihood that an out-of-court settlement could be achieved.¹⁹⁵

In early 1995, in an effort to ensure that the original large-scale hydro-project would not be revived, Hungary began final demolition of the dam at Nagymaros.¹⁹⁶ Plans call for building facilities for yachts and other water sports at the site.¹⁹⁷ Similarly, in an effort to maintain the viability of the hydroelectric project and to maximize power output (despite the absence of the Hungarian portion of the project), in January 1996, Slovakia installed the eighth and final turbine at the hydroelectric power plant at Gabčíkovo making the plant fully operational for the first time.¹⁹⁸

Notwithstanding, both sides continue to maintain their staunch positions, claiming that while their particular actions conformed to both environmental conservation efforts and international law, the other side acted contrary to these ideals. Slovakia, however, did increase the amount of water

1995, available in LEXIS, Nexis Library, Wires File (discussing planned talks between the two countries); Horn, Meciar Seek Gabčíkovo Agreement Without the Hague, CTK, Sept. 4, 1995, available in LEXIS, Nexis Library, Wires File (describing a meeting between the Slovak and Hungarian premiers at which the parties suggested that a resolution could obviate the need for the court case); *Schenk Expects Approval on Division of Danube Waters*, CTK, April 12, 1995, available in LEXIS, Nexis Library, Wires File (discussing temporary water distribution agreement reached by Hungary and Slovakia).

195. See *Hungary Sees No Quick Fix for Slovak Dam Dispute*, Reuters, Feb. 13, 1996, available in LEXIS, Nexis Library, Wires File (noting concerns of Hungarian Foreign Ministry spokesperson); *Members of New Cabinet Comment on Tasks; New minister Allows for Agreement on Gabčíkovo*, BBC, Dec. 15, 1994, available in LEXIS, Nexis Library, Wires File [hereinafter *Members of New Cabinet Comment on Tasks*] (quoting Slovak Environment Minister, Jozef Zlocha, as stating that the dispute will probably not be resolved without the assistance of the World Court).

196. See *Gabčíkovo Builder Regrets Puling Down of Nagymaros Dam*, CTK, March 18, 1995, available in LEXIS, Nexis Library, News File (discussing the demolition of the dam); Emil Varadi, *Hungary Starts Final Demolition of Nagymaros Dam*, Reuters, Dec. 9, 1994, available in LEXIS, Nexis Library, Wires File (noting that Hungary began taking final steps toward demolishing the dam in late 1994).

197. Veradi, *supra* note 195.

198. See *Internal Economic Affairs: Gabčíkovo Hydroelectric Plant Fully Operational*, BBC, Jan. 24, 1996, available in LEXIS, Nexis Library, Wires File (discussing full operation of Gabčíkovo power plant).

flowing into the original channel of the Danube River¹⁹⁹ after allegations continued and evidence suggested that the diversion of the Danube deprived the Szigetköz wetlands region in Hungary of much-needed water.²⁰⁰ The interval of flow, however, has been rather irregular while the volume far small than that which originally flowed through the channel.²⁰¹

The case may be placed on the World Court's agenda as early as the spring of 1996.²⁰²

199. See *Simulated Inundation To Start at Gabčíkovo Tomorrow*, CTK, July 20, 1995, available in LEXIS, Nexis Library, Wires File (discussing plan to gradually increase water in the those regions that were dried up); *Slovak-Hungarian Agreement on Water Replacement*, MTI, April 19, 1995, available in LEXIS, Nexis Library, Wires File (discussing the agreement reached by the two parties over water allocation); *Members of New Cabinet Comment on Tasks supra*, note 194 (quoting Slovak Environment Minister, Jozef Zlocha, as stating that such an agreement may be reached).

200. See *Slovakia's Gabčíkovo Dam Threatens Ecosystem* - WWF, Reuters, Sept. 13, 1995, available in LEXIS, Nexis Library, Wires File (discussing results of World Wildlife Fund report, which claims that up to ninety percent of the plant and wildlife in the Danube's floodplain is threatened with extinction); see Eva Munk, *Gabčíkovo Threatens Wetlands and More*, THE PRAGUE POST, Oct. 26, 1994, available in LEXIS, Nexis Library, Papers File (describing some of the claimed environmental degradation resulting from the diversion of the Danube and construction of the Gabčíkovo Dam).

201. See *Hungarian Hydrologists Speak on Dam Dispute with Slovaks*, WATER BRIEFING, Oct. 19, 1994, available in WESTLAW, Allnews File (noting that water flow into the Szigetköz region has been irregular and at levels lower than agreed upon).

202. See *Gabčíkovo Dam: Foreign Minister Says Gabčíkovo Dam Issue May go to the International Court*, BBC, Jan. 25, 1996, available in LEXIS, Nexis Library, Wires File (quoting statement of Hungarian Foreign Minister).